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REPORT

OF THE

STATE BOARD OF HEALTH

UPON THE

SANITARY CONDITION

OF

FACTORIES, WORKSHOPS AND OTHER ESTABLISHMENTS WHERE PERSONS ARE EMPLOYED.

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Commonwealth of Massachusetts.

Office of the State Board of Health,
State House, Boston.

To the Honorable Senate and House of Representatives.

I have the honor to transmit to the Legislature the report of the State Board of Health on the sanitary condition of factories, workshops and other establishments where persons are employed, required under chapter 59 of the Resolves of 1905.

CHARLES HARRINGTON,
Secretary of the State Board of Health.

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CONTINUATION OF THE INVESTIGATION OF CONDITIONS AFFECTING THE HEALTH OR SAFETY OF EMPLOYEES IN FACTORIES AND OTHER ESTABLISHMENTS.

To the General Court of Massachusetts.

By chapter 59 of the Resolves of 1905, the State Board of Health was directed to continue the investigation of conditions affecting the health or safety of employees in factories, workshops and other places of employment in the Commonwealth which had been begun under authority of chapter 99 of the Resolves of 1904, the results of which were transmitted to the Legislature of 1905, and may be found in the thirty-sixth annual report of the State Board of Health, pages xxii–xxxi.

The industries reported upon at that time included cutlery grinding, stone cutting and stone polishing, cigar making, boot and shoe making, rag sorting, the rubber industry and the lead industry. Nearly all of these industries were regarded as being among those most dangerous to the health of those working therein, but even here it was found that one at least, and sometimes many establishments in each industry were carried on with satisfactory regard for the health of the working people.

This condition led this Board to recognize that the most efficient and just method of improving the conditions of the working people in each of these industries would be to require those proprietors who carry on their work with little provision for the health of their employees to make such provision as is made by those who provide the best. This is the most practicable method of bringing about improvement of existing conditions where necessary and of encouraging those employers best disposed to improve still further the conditions regarding the health of all employed.

This recognition caused the Board to recommend "that it be the duty of the inspection department of the district police to require, so far as is reasonably practicable under the varying circumstances, as efficient protection to the health of the operatives in any occupation as is provided in that occupation where, within the Commonwealth, such protection is most efficient."

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During the past two years further observations have been made upon the industries previously examined, together with the following: —

Manufacture of agricultural implements, bluing, bone black, brushes, carpet yarns, carpets and rugs, celluloid goods, chairs, chemicals of various kinds, colors and mordants, electrical apparatus, emery and corundum wheels, facing, felt cloth, felt hats, files, firearms, glue, horn goods, jewelry, lampblack, lead pipe and plumbers' supplies, leather, lithographs, machinery, mouldings and frames, optical goods, pearl buttons, pianos, pottery, sandpaper, shoddy, soap, stains and blackings, stoves, stove polish, straw hats, textiles, tools, varnishes, watches, whips, whiting, wire and wire cloth; bakeries, bleaching and dyeing, dyeing and cleansing, galvanizing, glass grinding, iron, steel and brass founding, laundries, rendering and slaughtering.

The conditions affecting the health and welfare of the working people in these industries are recorded in the Supplement. In many the conditions were found to be satisfactory. In the emery and corundum, sandpaper and certain other industries more attention should be given to keeping the dust away from the mouth and nostrils of the workmen. In the rag dusting, sorting and cutting rooms of some paper mills very objectionable amounts of dust were found, with some pale and sickly appearing operatives; but there are mills using the same kind of stock where the dust is kept away from the employees in a satisfactory manner, and much improvement is practicable in the former class. In the manufacture of shoddy and of the products of jute and hemp there are processes which are exceedingly dusty, requiring much improvement in the poorly managed establishments.

Machine shops are generally found to be in fair and some of them in very good condition. The departments connected with foundries, including casting, scaling, cleaning and smoothing, grinding and polishing, involve exposure to extreme heat, fumes and dust, which may be very injurious to the workmen. The extent to which the workmen are protected varies greatly in different establishments; but there are many where the protection is very satisfactory, and it is desirable that others be brought up to their condition. The same may be said of the brass and iron foundries.

The cutlery and tool industry is one of the most dangerous of trades, but there are enough establishments in which the grinding and polishing machines are provided with hoods and exhaust fans to show that the danger to health may be greatly relieved; but even when so provided many workmen recklessly remove the hoods, and expose themselves to the great danger of breathing the dust made up of fine particles of steel and of the grinder. It is possible that improvements may be made in the apparatus for removing dust that will make them less dangerous to the workmen. That the workmen do not take every means to protect themselves indicates that they do not appreciate the shortness of the lives of those who enter this industry, and that there are two or three times as many deaths, proportionately, among grinders, polishers and cutlers, due to diseases of the lungs, as among other male adults in the same community.

In cigar making we find some establishments carried on in a satisfactory manner, with good light, good ventilation and no spitting; but there are many where these conditions are far from satisfactory, and they need to be brought up to those of the better class. Too large a percentage of the operatives look pale and sickly.

In the rubber factories examined during this investigation the greater part were in better condition than those previously reported upon; and in this, as in other industries examined, those allowing poor conditions affecting the health of the operatives should be brought up to the conditions found in the better class.

In many of the smaller industries conditions requiring improvement are noted in the Supplement, and are not repeated here. The dangers accompanying the use of wood alcohol are not enlarged upon, because the removal of the tax on denatured grain alcohol is expected to prevent the further use of wood alcohol.

The Boot and Shoe Industry.

The great number of people employed in the boot and shoe industry in this State, and the great difference found in the care devoted to the health of the employees in different establishments, warranted a much more complete examination than has previously been made, the details of which are presented in the Supplement.

In this examination 373 establishments were visited, of which 62 were found to be with good conditions regarding the health and welfare of the working people, 220 with fair general conditions, 72 with poor conditions, and 19 with distinctly bad conditions. Of those whose general conditions are called fair, some parts were in good condition; but there were conditions in some rooms and places which distinguished them from those having general good conditions, such as poor ventilation, or water-closets not commendable.

While there are, among the older small establishments and the more modern and large establishments, many which well may be regarded as standards of excellence, there are common to this industry four conditions which can be and ought to be remedied. These are: poor ventilation, inadequate removal of dust from machines; the condition of water-closets; and spit upon the floors.

In the majority of factories visited the ventilation was found to be poor, and in many of them distinctly bad. Of the rooms not especially dusty, 102 were badly ventilated and 26 were overcrowded. In the rooms in which large amounts of dust are evolved, the number of machines with means for efficient or fairly efficient removal of dust was found to be 1,630; the number either inefficiently equipped or devoid of equipment was 2,769.

Of 84 of the many dusty rooms reported, 40 were also overcrowded, 35 were dark, 21 were overheated, and 18 were overcrowded, dark and overheated. In more than one-third of the factories visited the conditions of water-closets were not commendable; most of them were dark and dirty to very dirty. In 50 establishments no spitting was noticed, in 173 there was some, in 115 considerable and in 35 much.

In some establishments lunch rooms are provided, where the employees may eat the luncheon they have brought, or may buy one; in much the larger number the employees eat in the workrooms.

In the opinion of our inspectors, the health of the employees in this industry in the larger number of establishments appears to be fair to good; but in 85 factories, or 23 per cent. of those visited, a considerable proportion of the employees are noticeably pale and unhealthy.

In the boot and shoe industry, as in most other industries in the State, we find a class of establishments in which satisfactory provision is made for the welfare of the employees, and methods are adopted for carrying on business by which their welfare is promoted. At the other end of the scale there is a minority — not large, but altogether too large — where the conditions injuriously affecting the health of the operatives appear to have no consideration, are contrary to the intent of the laws governing factories, and are such as the better class show to be unnecessary in carrying on this business.

These unjustifiable differences urge us to recommend that laws be made to require that the conditions affecting the health of the working people in these poorly managed establishments be brought up to conditions existing in the class of establishments doing similar work in similar buildings where their health is most carefully protected; and that it be the duty of the inspectors of factories to see that the laws to bring this about are enforced.

THE TEXTILE INDUSTRY.

During the past two years the Board has made careful investigation into the conditions affecting the health, safety and welfare of persons engaged in the great textile industry of the State, the details of which inquiries are contained in the Supplement.

In this industry we find, in establishments employing much more than half of the total number engaged therein, that the conditions regarding the health, safety and welfare of the employees are good; and in about one-third of this number they are excellent. On the other hand, we find establishments containing a large minority of operatives where the conditions are moderately bad; and perhaps in one-third as many as we regard good are conditions which are decidedly bad.

The problem before us is to have the conditions affecting this minority raised to those which we find to be good; and we have confidence that, so far as this can be accomplished, we shall find the good conditions made better.

The resolve under which the foregoing investigations were made also directs this Board to report to the General Court on or before Jan. 15, 1907, such recommendations as it may deem expedient for the revision of the laws in this Commonwealth relating to the health, safety or welfare of persons engaged in industrial pursuits.

These laws are found to contain requirements upon nearly all of the conditions desired, but they are often in such form that no officer can enforce them unless he has support from something more than the mere statement of the law; for example, all would agree that cleanliness in a factory is a necessary condition relating to the health of operatives; and we have in the Revised Laws two references in substantially the same words, viz.: "All factories shall be kept clean." What is clean in an axe-grinding factory would not be clean in a silk mill; but the law makes no distinction, and the judgment of the officer cannot be received as law. In prosecuting an offender, he would have no backing in the law unless it should be some extremely bad case, in which he could satisfy the court that it was a nuisance; but such a course would have no effect in enabling him to hold factories up to the standard of cleanliness that is desirable for the health of the operatives; and we conceive it impossible to specify in any law a standard of cleanliness applicable to all industries. This being the case, and happily finding, in nearly all of the industries which we have examined, some examples of establishments where reasonable conditions of cleanliness are maintained, we should advise making it of the law that the officer should be authorized to hold all factories in any industry up to the standard of cleanliness which he finds maintained in the factories in that same industry and using the same grade of stock, which are the cleanest.

This might not be acceptable to a manufacturer who was not permitted to examine the mills of his competitors, to which the officer has access. To settle any question that might arise as to the requirements of the officer and the comparative condition of the mill in question, and the standard above set forth, an appeal might be made by either party to the State Board of Health, authorized to examine such factories in the interests of health and to make a final settlement of such questions.

Other conditions, such as proper provision for preventing the entrance of dust into the air of the room, proper means of ventilation, proper provision for regulating light, heat and moisture, could be referred to similar standards, — standards not necessarily of methods, but of resulting conditions, which those interested to keep their operatives in the best condition of health, and consequently the most efficient, have found to be practicable.

The subjects of importance which are not mentioned in the laws regarding factories are the regulation of light, and spitting.

It might be expected that a manufacturer regarding only his own interests would keep the windows of his factory clean and the walls and ceiling of the room whitened, that he might have upon his work the best natural light; but we have found some factories where these conditions were neglected, and the operatives were straining their eyes trying to accomplish the work required of them. In some there was a period in the afternoon when daylight was too dim, and the turning on of artificial light was delayed, to the injury of the eyes of the operatives and probably to the injury of the work done.

It is well known that a large percentage of deaths among people whose working days are spent within the walls of industrial establishments is due to consumption. While this may be quite as much due to the conditions existing at the homes of the working people as to those existing at their working place, it is eminently unjust to those who maintain their homes in order and do everything needful to prevent the occupants from contracting consumption, that they should be obliged to seek employment in factories where the most potent means of spreading consumption are allowed to exist.

No one can spend his or her working days in a room where others, in incipient stages of consumption, habitually spit upon the floor, without the gravest danger of acquiring the disease. Such incipient cases are not always easy of detection; and the only safe protection is to prevent all spitting upon the floor or elsewhere, where the sputum on drying will be disseminated as dust through the air of the room. Experience in some factories shows this prevention to be practicable.

The modifications in the laws relating to the health, safety or welfare of persons engaged in industrial pursuits are the following; but, as the enforcement of these laws depends in general upon members of the inspection department of the District Police, it is essential that this department be composed of broad-minded men, who have the welfare of the working people at heart; and have the ability to study out the requirements in any factory for their welfare, and how these can be accomplished consistent with the standards which they are to follow; and, further, are able to act justly and with tact with the employers.

AMENDMENTS AND ADDITIONS RECOMMENDED.

Chapter 104 of the Revised Laws, section 25, in regard to fire escapes, add to the clause in lines 19 and 20 so that it shall read: —

The egresses and means of escape shall be kept unobstructed, in good repair and ready for use, and shall be provided with a sign within the building that will plainly indicate their position to a person thirty feet distant.

In section 41 the last clause to be modified to read: —

All factories and workshops shall be well lighted, well ventilated and kept clean.

Following which add: —

No person shall expectorate or spit upon the floor, stairways or walls of any factory or workshop.

Chapter 108 of the Revised Laws, section 8, beginning with the end of the seventh line, and including the eighth and ninth lines, amend to read: —

the lighting and the ventilation of factories or workshops and the keeping of them clean, and the securing of proper sanitary provision therein, and the making of clothing in unsanitary conditions.

Also insert in thirteenth line, after "sanitary provisions," the words "the lighting."

And to this section (8), which puts the responsibility of enforcing the laws which have been considered upon the members of the inspection department of the District Police, add the following: —

When determining whether the conditions affecting the health, safety or welfare of the working people in any factory or workshop are in accordance with the law, and the law does not specify the standard of such conditions,

said inspectors are to use as standards the conditions which they find existing in those factories and workshops carrying on similar business in similar buildings within the Commonwealth, where the health, safety and welfare of the working people are most completely protected.

Should questions arise in regard to such standards, between the said inspection department and the person carrying on such factory or workshop, said questions may be referred in writing, by either of the parties, to the state board of health, which board is hereby authorized to investigate and decide said questions, and the decision of said board shall be final.

By order of the Board,

CHARLES HARRINGTON,
Secretary of the State Board of Health.

SUPPLEMENT.

Prepared by the Secretary of the Board.

SUPPLEMENT.

PREPARED BY THE SECRETARY OF THE BOARD.

In the course of the investigation of conditions affecting the health, safety or welfare of persons engaged in factories and other establishments, made by the State Board of Health, as directed by chapter 59 of the Resolves of 1905, more than 60 industries were examined. Attention was paid chiefly to those in which one or more of the essential processes involve exposure of the employees to possible unhygienic influences inherent to the industry.

The in-door occupations of chief sanitary interest are those which involve exposure to irritating and poisonous dusts; exposure to irritating, poisonous and offensive gases and fumes; contact with poisonous substances; extremes of heat and excessive dampness.

Of the several classes of dust, — those of vegetable, animal, metallic and mineral origin, — it is difficult to determine which is the most irritating to the respiratory tract; but the vegetable dusts are commonly so regarded, in spite of the well-known fact that the occupations in which the employees inhale minute particles of steel, glass and stone are remarkable for their high death rates from tuberculosis of the lungs. But not all of the dusts of one class are equally irritating; flax and cotton, for example, are more irritating than wood; steel is more irritating than brass; horn is more irritating than bone; granite is more irritating than marble, and glass far more than granite.

Workers exposed to dusty atmospheres are especially prone to diseases of the lungs, especially pulmonary tuberculosis, the constant irritation bringing about a condition of the mucous surfaces which more readily admits of invasion by the specific germs. Those who are exposed to poisonous dusts are, unless proper precautions are observed, likely to fall victims of chronic poisoning. The most dangerous of the metallic dusts met with in this investigation are those of lead and its compounds.

Of the various gases and fumes to which workmen are exposed, those which are merely irritating are of far less importance than those which are poisonous in their nature. The irritating fumes cannot be borne in large amounts, and they cause the person exposed to seek the relief afforded by fresh air. In small amounts they cause slight tickling cough and perhaps catarrhs. Of the poisonous fumes, the most important and commonest met with in this investigation are those of naphtha and wood alcohol. Both of these substances are used in very many industries, as will be noted below. Naphtha fumes cause various forms of intoxication, especially in women. Among the symptoms are dizziness, nausea and vomiting, headache, hysterical phenomena, disturbances of the circulation and respiration, and mental confusion. In the periodical literature of industrial hygiene are not infrequently reported cases of fatal poisoning therefrom. Of equal or greater importance are the fumes of wood alcohol, which agent is very largely used, as a cheap substitute for grain alcohol, in varnishes, etc. Of late years it has become well known that, taken as a beverage, wood alcohol is likely to cause death, preceded by total blindness; but it is not commonly known that exposure to the fumes has caused many cases of serious impairment of vision and not a few of total blindness, due to action upon the optic nerves.

Offensive vapors and fumes may cause general disturbance of the digestive system and headache for a time in persons who are not habituated thereto; but as a rule tolerance is soon established, and they are not even noticed. In certain industries the raw materials are of an exceedingly offensive character, and give off at all stages of manufacture nauseous odors which the employees are compelled to breathe; these include the so-called offensive trades, such as soap making, glue making, tanning, rendering, etc. The noisome odors are an unavoidable feature of the business, and are popularly, but wrongly, regarded as conducive to the occurrence of infective disease.

In addition to inquiring into the measures adopted for the protection of the health of the employees against the inherent dangers of the various lines of industry, careful examination was made of the character and condition of the water-closets and washing facilities, of the provisions for rapid egress in case of fire, of the conditions as to general cleanliness and light, and of the extent to which the very dangerous habit of promiscuous spitting prevails.

In the report submitted in 1905 reference was made to the fact that the presence of consumptives in workshops constitutes a menace to the health of their associates, even though they may not be addicted to this habit. The reason lies in the fact that in their every act of coughing, sneezing and speaking, minute droplets of saliva, which may contain the specific bacilli of the disease, are sent forth into the air, in which they remain suspended for varying periods, to be perhaps inhaled by others. The spitting consumptive — and here it may be remarked that many a person may be a victim of the disease for a long time before the fact becomes established by the usual diagnostic methods — is a far greater menace to the health of others, because his sputum, cast about upon the floor and elsewhere, becomes dried on exposure to the air, and then may be reduced to powder and sent in all directions through air currents or by dry sweeping and other mechanical means. It is a well-known fact that a very large proportion of deaths among those whose days are spent in in-door occupations is due to pulmonary consumption, and that this obtains in the highest degree in those industries whose followers are exposed to irritating dusts. In many of the reports which follow, mention is made of the extent to which the spitting habit was observed to prevail; where no comment is made, it may be understood that little or no spitting was noted.

With regard to light, it may be said that, although good light may not be a necessary factor in all of the various kinds of work, and poor light may not always lead to injury, the effect of well-lighted rooms, if only to exert an unconscious influence upon the minds and spirits of the workers, is highly desirable as a concomitant factor in the maintenance of health.

Reports on the individual industries investigated are submitted below, beginning with those in which the predominating inherent objectionable feature is dust, following by those which involve exposure to various gases and fumes, and concluding with several belonging to neither class. One of these is the public laundry business, in which there exists constantly the danger of possible exposure to infective matter from the bodies of the sick. The others are of constantly increasing public interest, respecting the possible insanitary influences to which the workmen are exposed, and unwholesome conditions to which our most important foods are subjected; these are baking and slaughtering.

The reports of the various industries in which dust is the predominating factor of importance are presented, according to the nature of the dusts, in the following order: vegetable, animal, mineral, metallic. Certain branches of the chemical industry in which there is exposure to dust will for convenience be taken up with the chemical industry as a whole, in which one meets with all kinds of dusts and fumes, and which, being more closely associated with the latter, whichever may be said to predominate, is presented after the dusty trades.

The examinations were not made by experts in the various lines of work, but by hygienists; and therefore, while the description of some of the processes may not be in all respects technically accurate, the statements as to hygienic conditions may be accepted as authoritative.

THE TEXTILE INDUSTRY.

The textile industry in Massachusetts employs a larger number of persons in its factories than any other industry, and the majority of the employees are women and minors.

Its importance can best be comprehended by reference to the reports of the national census of 1900, wherein it is shown that the value of its products ($1,625,000,000) in the whole country is surpassed only by that of food products ($2,275,000,000) and of iron and steel ($1,790,000,000).

Massachusetts stands first in the production of both cotton and woolen goods, and in textiles as a whole. The value of her textile products in 1900 was $213,000,000; Pennsylvania stood second, with $157,000,000; and New York third, with $93,000,000. The value of her cotton products was $110,000,000, which surpasses by $5,000,000 the combined value of the cotton products of the four next important cotton manufacturing States, namely, South Carolina, North Carolina, Rhode Island and Pennsylvania. The value of the woolen goods produced in Massachusetts in 1900 is stated to be $73,500,000; Pennsylvania stands second, with $50,000,000; and Rhode Island third, with $39,000,000.

Official reports and scientific papers on the textile industries of various foreign countries have led to a general belief that the operatives engaged therein are exposed to such unhygienic influences as to warrant the classification of these industries among those which are especially inimical to health and longevity. It is a fact that dust from cotton and flax is particularly irritating to the respiratory passages, and that those long exposed thereto in considerable amounts may become more or less susceptible to infection by the exciting cause of tuberculosis. It should be borne in mind, however, that the character of many of the processes is such as to attract, here as elsewhere, large numbers of those of weak constitution and inferior development, who, whatever in-door occupation they may select, are least likely to oppose effective resistance to disease. In a previous report on industrial conditions in Massachusetts it was shown that a very large proportion of the decedent operatives in three mill towns of the State died of pulmonary tuberculosis and other diseases of the lungs; but further study of existing conditions compels a revision of opinions based upon the data then at hand.

Analysis of the death returns to the office of the Secretary of State during the year 1905, from the three principal "mill towns," shows that, although tuberculosis is one of the leading causes of death among mill operatives, the general death rate of this class was by no means abnormally high, being respectively 7, 8 and 10 per thousand. Tuberculosis caused, respectively, 32, 23.57 and 21 per cent. of the deaths. It appears also that the general death rates of the cities whose populations include the highest percentages of textile operatives compare not unfavorably with those of certain other cities which are engaged in other kinds of manufacture or are more residential in character, in spite of the high rate of infant mortality which appears to be inseparably connected with mill populations everywhere.

The magnitude of the industry, the character of the conditions of operation, the sex and age of the majority of the persons employed, and the above-mentioned generally accepted opinion that those engaged in textile factories are exposed to exceptionally unhygienic influences, suggested the advisability of a particularly thorough study of the conditions obtaining in a large number of mills of various types, sizes and ages. Because of the great extent of the industry, it was impossible, with the force available, to visit every establishment, but in a number of the "mill towns" nearly all were studied.

Processes of Manufacture.

For an adequate understanding of the possible unhygienic conditions to which the operatives may be exposed, a description of the various processes of manufacture is herewith presented.

Opening the Cotton. — Raw cotton is brought from the storehouse directly into the opening room or the picker room, according to the method of opening the bales.

One of the most modern mills visited has an opening room across the street from the mills. The cotton is opened and torn into small pieces by machinery, by means of a series of spiked aprons; then by conveyor belts, pipes and suction fans it is taken underground to the picker room in the mill, where, by a system of switches, it is dropped into the different bins ready for the first picker machine.

When the cotton is opened by hand, men take the bales to the cotton bins, where they break up the cotton into small masses, mixing the various grades as required.

Picking. — In the picker room, heavy machinery opens up the fiber, mixes it, beats it, cleans it, and delivers it in even sheets, or layers, known as "laps." The picker process varies somewhat, according to the class of work done.

The first picker machine is fed by a "feeder," which holds about 250 pounds of cotton. Usually one man attends five or six of these machines. The feeder ends of the machines are near the cotton bins, from which the man takes the cotton by armfuls, keeping the feed boxes filled.

Work done by the Picker Machines. — The picker machine may be a "compound picker," which combines both opener and breaker, containing two "beaters." With this machine a large part of the cotton-seed and large cotton leaf is removed, leaving the cotton in the form of an even sheet or "lap."

The laps, weighing about 50 pounds each, are taken from the front of the "compound picker" by a workman, who places four of them on an apron of a "one-beater" picker, known as the "intermediate picker." He takes the laps from five or six of the first kind of pickers, and keeps the aprons of the intermediate pickers filled. The intermediate machines remove still more of the dirt and seeds, and are always to be associated with the English system of carding, mentioned below.

The cotton is now put through the "finisher" picker machines. These pickers remove the balance of the seed and large leaf; the small leaf is later removed by the carding process. The "laps" are now weighed, and, if found to conform to a certain standard, are taken to the carding room.

Necessary Conditions in a Modern Picker Room. — As cotton opens in the field it catches and holds much fine dirt, blown about by the winds; and when it is subjected to the treatment of the beaters in the picker machines, the dirt, bits of seed and leaf are forcibly separated. This material is not confined in the machine. By means of exhaust fans the cotton is drawn away from the "beater" and collected on a cage. The partially cleaned cotton comes out in front of the machines in the form of "laps," already described; while the motes and bits of leaf and seed, when separated from the cotton, fall to the enclosed space beneath the machines, from which the loose dust and sand are blown through pipes to a room called the dust room, which is connected with a large chimney. In spite of the well-constructed modern picker machines, a considerable amount of fine dust escapes into the workroom, — very slight, however, as compared with the amount which escapes from some of the older machines.

Fires are frequent in the picker rooms, but are seldom dangerous to the men employed. The precautions against loss of property, now generally taken, also protect the employees from injury.

The modern picker room is high studded, has several windows which admit sufficient light, and is equipped with incandescent bulbs or arc lights.

It is unnecessary to give much attention to the regulation of moisture in the picker room, except that excessive moisture must be avoided, lest the work may run badly in some of the later processes; hence, precaution is taken on damp days to prevent extra moisture getting into the room.

The services of but a few men are required in a picker room, and, excepting the foreman, the men are of little or ordinary intelligence, the work being classed as "unskilled labor." In addition to tending the picker machines, it is the duty of these men to clean each machine several times a day. The work may or may not be constant. Generally the men known as "yard men," who unload the cotton, put it in tiers in the storehouse and take it to the picker room.

Carding. — From the picker room the cotton is taken in the form of cylindrical laps to the carding room, where it passes through the carding machines. Cotton-carding machinery has made great advances in recent years, and the best mills have kept fully abreast with the latest improvements. The laps are placed on a revolving-top flat card, which is an English type card (English or American make, but patterned after the original English card).

The carding machine cleans the cotton further by removing a certain amount of short fiber and leaf, the amount being governed by the adjustment or setting of the card. The adjustment is governed by the class of work; *e.g.*, in the manufacture of print goods, short, dirty cotton is used, while the fine goods mills use long-staple, high-grade cotton; and, in manipulating the latter, foreign substances in the cotton must be removed so far as possible. The amount of work on cards is also governed by the class of work, a small amount being put through the machines in the higher class. Thus it will be seen how, in the manufacture of print goods, with the use of short, lower-grade cotton, and with the large output per card, much more dust, dirt and lint arise from the machines than during the manufacture of fine goods, with the long-staple, high-grade cotton.

The carding machines subject the cotton to the action of cylinders covered with wire-toothed cards, revolving nearly in contact with each other, at different rates of speed or in opposite directions. Because of their construction, they permit some of the fine lint or "fly" to escape into the room, an amount at times sufficient to cause a distinct haziness of the air.

The operation of carding not only further cleans the cotton, but disentangles, straightens and parallelizes the fibers. The "lap" is first presented to a small cylinder called a "licker-in," which delivers to a much larger cylinder having fine wire teeth. Partly surrounding the larger cylinder are "flats," or a series of plane surfaces, also covered with teeth, which approach those of the cylinder as closely as possible without touching. Between the revolving cylinder and the flats the carding is effected; and the cleaned and straightened fibers are delivered to a third cylinder, called a "doffer," which "doffs" or strips off the cotton in the form of a delicate web. This web is then delivered to rollers, which draw it through a funnel-shaped orifice in the form of a soft, narrow strand, in a loose, untwisted state, called a "sliver," which is introduced into a can by a coiler, which is also part of the carding machine. The work of the carding machine is now completed, although other processes are closely associated with carding.

In the medium or coarse goods mills the carding machines are generally found in one end of a long room, and the associated processes are followed in the other end, there being no partitions between the departments.

The employees in the card end of the room are adult men; while those in the other part, on work to be described later, are women.

Since the amount of cotton dust thrown out into the room by carding machines is greater in proportion to the amount of low-grade cotton used and the large output per card, it follows that all of the operatives in such rooms are exposed to considerable cotton dust, although the men attending to the cards are subjected to the greatest quantity. In some of the coarse-goods mills the carding room contains carding machines only. These rooms are exceedingly dusty.

The men employed include both "skilled" and "unskilled help." They put the "laps" in the back part of the card, and clean the cards, both inside and out, several times a day. The sliver in cans is carried away by the can boys.

The greatest amount of dust comes from the cards when the men remove the waste from the cylinders. The short, broken fibers are again stirred up by sweeping the floors from time to time, by cleaning the shafting and pulleys and by brushing the walls, thus giving rise to an extra amount of cotton dust or "fly" in the air of the room. The men work in this room throughout the day, averaging fifty-eight hours per week.

Extremes of heat or moisture in the carding room would interfere with the work either in the carding process or in some of the later processes. Some of the mill men introduce artificial moisture in the carding rooms; others do not, on the ground that there is sufficient natural moisture in the cotton. Very moist air, on the other hand, would cause the cotton to stick to some of the machinery; moreover, it would cause the delicate web which comes out of the front part of the card to sag or break down. Another condition which, it is claimed, interferes with the work, is the existence of strong air currents, which would readily disturb, if not destroy, the delicate web.

Considering these conditions from a hygienic point of view, it may be said that a carding room with either excessive heat or excessive moisture is seldom found. The practical questions to be met in the carding room are two, viz.: (1) how to diminish substantially the amount of dust in the room; and (2) how to ventilate the room properly, — both to be accomplished in old mills, with "reasonable" expenditure. Emphasis is laid upon "old" mills, for the reason that in these the rooms are commonly low studded, with small windows, and devoid of modern means of ventilation and heating. The modern card room is very large and high studded (*e.g.*, 15 feet), with good-sized window glass, and transoms which are easily opened; it is well lighted with arc or incandescent lights, and is heated and ventilated by modern means. In some of the rooms are two or more large exhaust fans. The ceiling and walls are clean and white, and the floor is kept reasonably clean during working hours.

Drawing and Combing. — The cans of loose, untwisted cotton, or "sliver," from the carding machines are now ready for the next process. In the manufacture of plain cotton cloth of medium weight, this process, called "drawing," results in combing several strands into one, and attenuating these more and more by repeated operations of the same sort. If, on the other hand, a high-priced and extra quality of yarn is to be spun, the "sliver" goes directly from the cards to the combing machines, after first being prepared for the combers by a series of doublings and drawing on the "sliver" and "ribbon lap" machines. This work preparatory to combing is usually done by young men.

In the process of combing the short stock and foreign substances are removed from the cotton, the quantity of which is governed by the class of work the particular mill is running. Cotton-combing manipulates the fiber so thoroughly that the proportion of waste is large. It leaves the fibers more nearly parallel than in the carded sliver. In some cotton mills equipped with the latest patterns of combing machines all of the yarns are combed as well as carded.

The combing process is more satisfactorily followed in a room entirely separate from the carding machines, since the combers are delicate machines, requiring fine adjustment, and the presence of much dust in the air of the room interferes with the work. For this reason a glass partition, which separates the cards from the delicate combing machinery, has been erected in a number of carding rooms.

The employees engaged in the combing department are women. Their duties are to keep the machines supplied with laps; to remove the product, which is in the shape of slivers coiled into cans; and to keep the machines as clean as possible. The work, while not hard, requires constant attention. The women are notified and drilled not to clean the machines when in motion; but, in spite of this discipline, a considerable number of injuries occur. The type of injury is the mutilation or severing of fingers or hands by the series of strips of needles in the combing apparatus. The product is taken by girls, or comber tenders, to the drawing hands, to be passed through the drawing frames.

The principal mechanism of a drawing frame consists of three or four pairs of rollers, which grip the sliver tightly, and successively revolve at higher speeds. Thus six strands of sliver are united and drawn into one, smaller than any one of the six, and much more even. Two or three of these drawing frames are used; the second receives the product of the first, and so on. The employees are mostly young men. They keep the material going through the back of the machines and remove it from the front; they also keep the machines oiled and clean.

Roving. — Roving is an intermediate process between combing and spinning. The sliver of cotton has become so small that it must be twisted in order to bear handling; and the machines (usually three) which draw, twist and wind it upon bobbins into a soft, loose cord, ready for the spinner, are called "roving frames." The first is usually known as the "slubber," the next as "intermediate" (in fine-goods mills there is a second intermediate) and the third as a "fine frame;" and each successive machine gives a finer product, more nearly approximating yarn or thread, and operates at a higher speed. The slubbers (first process of roving) are generally operated by men. The product of the slubbers is handled by both men and women, while the rest of the work is generally run by women. The employees are required to keep the machines cleaned and oiled. The work previous to roving is "standing work;" that of the roving processes permits of intervals for sitting down. In some mills special seats are provided for the women employees.

The "fine roving" is the last process of the carding department.

The best results, from a commercial point of view, are to be obtained only by providing suitable atmospheric conditions as to heat and moisture in every room, beginning with the picking; but attention to these conditions is vital in roving and the later processes of spinning and weaving. Yarn produced in a room in which the temperature is allowed to fall too low and the air to become too dry is weak, uneven and covered with protruding fibers which are rubbed off in later processes; thus the quality of the yarn or of the cloth into which it enters is very much lowered.

Ring Spinning. — The roving, having been reduced to a suitable size for the intended "number" of yarn, now goes to the spinning machine, which may be either a "ring frame" or a "mule;" the ring frame being generally used for warp and the mule for weft yarn or "filling," although either machine is occasionally employed for both purposes.

The principle of the spinning machine is the same as that of the roving frames, though the mechanism employed is very different, and operates at much greater speed, the spindle generally revolving at from 6,000 to 10,000 turns per minute. The roving is again elongated by drawing rollers to an extent depending upon the size of the yarn desired; and the fully twisted thread is wound upon bobbins or tubes by rotating on the rapidly revolving spindles. The operations of the ring-spinning frame are continuous.

The temperature must at all times be sufficiently high to keep the steel rolls, through which the fine threads of cotton are drawn, warm enough not to cause the cotton to wind around the rolls instead of passing through them. The heat generated by the friction of the machinery in a ring-spinning room is at least sufficient to keep the room at a good spinning temperature in the winter months, provided the room is at a proper temperature on starting the mill in the morning.

By means of humidifiers, properly installed and rightly cared for, the amount of artificial moisture admitted into spinning rooms can generally be satisfactorily regulated, so that in some mills the unhealthy and objectionable system of "steaming" (steam vapor pot system) is abandoned.

The rapidly revolving spindles give rise to considerable cotton dust in the air of a ring-spinning room, in the form of fine, broken fibers, although the amount of dust is very small as compared with the quantity present in a carding room.

The employees are mostly boys and girls and women. The spinners place the roving in creels, piece up the ends when the thread breaks and doff the bobbins when full; they also keep their frames clean. The work requires neither especial intelligence nor unusual physical strength, nor does it demand constant attention. The spinners frequently find opportunity to sit. In some coarse work the spinners both spin and doff, and are, therefore, required to watch the work frequently; while in certain grades of work some young persons are employed solely for "doffing," and have a definite number of spindles to doff per week. In this case the "doffers," after doffing all the spinning frames, may leave the room until it is time to fill the frames again. Men look after the spinning frames, make changes and repairs, lay the roving on the creels and take care of the yarn after it is doffed.

Except for the continuous noise of the machinery, which is very great, but in an uninterrupted, unvarying tone, and for the loose cotton dust in the air of the room, the spinners in a modern, well-regulated, ring-spinning room work under favorable conditions. Such a room is well ventilated; properly heated; has large windows and transoms, which open; clean walls and ceilings; and is lighted by incandescent bulbs.

Mule Spinning. — In many mills the filling for the cloth is spun on frames called "mules." The operations of the mule-spinning frames are intermittent, the spindles being mounted in a travelling carriage which backs slowly away from the drawing rolls as the spinning proceeds, and then returns to wind a length of completed yarn; thus the process is repeated. The roving passes through the steel rollers as in ring spinning, but is drawn out about 60 inches by the travelling carriage before it is wound on the spindles.

Because of the long stretch covered by the travelling carriage, and since the filling has less twist than the warp, an extra amount of moisture in the air is necessary to prevent the ends from breaking.

The air in mule-spinning rooms is very warm and moist at all seasons of the year. In the winter months the thermometer registers between 80° F. and 100° F., varying according to the class of work and the care and method of regulating the heat and moisture.

The employees in "mule" rooms are all males; the spinners are men and the helpers are boys.

The men (spinners) must walk to and fro, following the movements of the "carriage," which is constantly moving backwards and forwards, and looking after the piecing of broken ends and the adjustment of the mule.

Much greater intelligence is needed in mule spinning than in ring spinning. In mule spinning, also, the spinner must pay close attention to his work, which, however, is not necessarily trying, under good conditions. The good mule room, like the good ring-spinning room, is well lighted and ventilated.

The boys are not constantly employed, but they are confined during the regular working hours, in order to be ready to doff the mule frames, which, unlike ring-spinning frames, are doffed at irregular periods. The boys place the roving in the creels, assist the spinners in doffing the full "cops" (*i.e.,* the conical masses of coiled yarn wound on spindles), and take the empty bobbins back to the card room. They keep the "carriage" clean by running their hands along it to take off the lint and dust which collect during the process of spinning. It is their duty to sweep the mule room floors two or three times a day.

Because of the high temperature in mule rooms, the men remove their outside clothing and wear undershirts and overalls, while the boys wear short trousers. Generally the men and boys go about the rooms barefooted, although some wear sandals, slippers or old shoes.

Spooling and Warping. — After the yarn has been spun it is prepared for the looms by the use of three consecutive machines, which form a part of one system. The first machine, the "spooler," transfers the yarn from the small bobbin on which it is spun to a large spool holding so many yards that the next machine, the "warper," will not have to be stopped to piece ends. The first machine also passes the yarn through a fine slot in the guide which leads it to the spool, in order to detect bunches or weak places, either of which will break the yarn at the guide. The defects are removed, and the sound yarn is tied to make a continuous strand.

The next machine, the "warper," prepares the yarn for the process of "dressing." A number of large spools filled with yarn from the spoolers, usually between 300 and 400, is put into a frame or "creel," and the threads are brought together into a sheet and delivered between guides, which space them at equal distances, then passed through mechanism calculated to stop the machine if a thread breaks, and led to and wound upon a large beam, called a "section beam," in order to get as much length as possible.

In the spooling and warping room a few fine fibers of loose cotton become detached from the threads as they are wound from bobbin to spool and from spool to beam.

The employees in the spooling and warping department include men, who place the bobbins on spooling frames; "spooler girls," who vary in age from young girls to middle-aged women; and warper tenders (girls), who mend broken ends. These girls find considerable time to sit, depending upon the frequency of the breaking of the ends. Some mills employ a few girls solely for the purpose of tying in the threads for the warping frames. The work of the "spooler girls" is constant, but not difficult.

Dressing or Slashing. — The section beams, having been filled at the warper, are arranged at the dressing machine or "slasher" in groups of four to eight, as may be required to furnish sufficient threads for a single warp. After the beams are placed in position at the back of the "slasher," the yarn is passed through a vat containing a sizing compound of hot starch, and then through squeeze-rolls to expel the superfluous starch. Squeezing the thread between rollers helps to fill the body of the thread with starch or "size."

After leaving the rolls, the sheet of yarn passes around large drying cylinders, made usually of copper, and filled with steam. One cylinder is placed in front of the other, the larger being about 7 feet in diameter and the smaller about 5 feet, each having a face of about 60 inches.

From these cylinders the yarn passes through "lease rods," to prevent the threads from sticking to one another, and is finally wound on the "loom beam."

A less common form of "slasher," instead of carrying the yarn over drying cylinders, is supplied with a closed box heated by steam pipes, in which a circulation of air is maintained by a fan, and through which the yarn passes to be dried.

Men are employed to run the slashers. The heat from the machines is considerable, and the men wear only undershirts, drawers and overalls; they do not go barefooted, as in the mule room. The work in this department is heavy and constant. Whatever dust appears in the air of the room is mainly small particles of starch.

Drawing-in. — The next operation in preparing the starched or " sized " warp for the loom is " drawing-in," which has until lately been wholly performed by hand. This process can hardly be intelligently described without at the same time considering the loom and its operation. For the loom to fulfill its function of interlacing warp and weft threads to form the usual continuous fabric, every alternate warp thread must be raised and the others depressed, while the weft or filling thread is passed across in the opening so made; after which the position of the warp threads is reversed, and the weft again thrown across. During the time occupied for reversing the position of the warp threads, the weft thread is beaten firmly and closely up against the one preceding it.

To raise and depress the warp threads alternately requires that they be drawn into the eyes of a " harness." A pair of parallel bars, holding cords stretched between them, each cord having an eye in it through which a warp thread is passed, serves to raise one-half the threads, while a similar apparatus depresses the rest; this forms the harness. All the warp threads, usually by twos, are then passed between short upright wires, closely set in a frame, which forms the " reed;" and, the weft thread crossing the warp in front of the reed, a forward motion of the latter beats it to place, as described.

For convenience, in the order of processes, the " drawing-in " apparatus is always near the slashers. When the slashing and drawing-in departments are in the same room, the warps from the slashers are taken to the drawing-in frames, which are invariably situated within a few feet of the windows, in order to secure the best light in the room for the " drawing-in girls."

A full warp beam is placed on an iron frame in front of a " drawing-in girl," who sits a few feet from a window, the light passing over her shoulders. The harness and reed are hung on the frame in front of her, and her work is to draw the warp threads in proper sequence through the eye of the harness and the spaces of the reed. The warp then goes to the loom.

The work is more or less trying to the eyes, but the best light available is given this department. The girls sit at their work, which is " piece work," and they sometimes continue working during a part of the noon hour, although contrary to the law and the printed notices posted in the room.

Weaving. — The warp, sized, wound on a beam and "drawn-in," is placed at the back of the loom; the harness and the reed are fixed in their proper places; suitable mechanism releases the warp and winds the cloth as the shuttle containing the weft crosses and re-crosses, and the reed is carried forward to beat each weft thread to place. No such preparation is required for the weft, or filling thread, as is given the warp. Usually it comes directly to the loom from the ring or mule spinning frame on which it is spun.

Both adult men and women work in the weave room; occasionally a few young persons.

As mentioned under roving, the provision for a suitable temperature and humidity are necessary for the best work. Especial attention is required in regulating the humidity during the prevalence of cold, dry weather, with high winds.

About the loom is more or less fine dust (starch and lint), which chafes off the warp threads as they pass through the harness and reed.

A small proportion of the men in a weave room are "loom fixers," who put warps into the looms, hang the harnesses and get the looms ready for weaving. They also make necessary repairs on the looms.

A weaver (man or woman) attends four, six, eight or more looms, according to the kind of work and the kind of loom. The weaver's duties are to put the cop into the shuttle, which is placed in the loom; to mend any broken warp threads; to observe all imperfections in the yarn, and to prevent them from weaving into the cloth. Each weaver keeps his looms oiled and cleaned.

More intelligence is required of an employee in a weave room than in any other department of a cotton mill; while that part of the work done by the "loom fixer" takes considerable physical strength.

Weaving necessitates constant attention, although the weaver finds time to sit at intervals.

The finer and more ornamented the fabric is woven, generally speaking, the more care and skill are demanded in the weaver. Some kinds of work require great strength and endurance; some kinds are repugnant, because of the conditions under which the work must be done, as in weaving dark-colored fabrics, or when dust arises from dyestuff or from shoddy; some kinds demand an unusual degree of perfection in the product, calling for constant and minute attention.

Thus it is clear that not only good light, evenly distributed, is a reasonable requirement in the weave room, but that good ventilation and proper regulation of heat and moisture are also hygienic essentials.

Finally, should be mentioned the monotony of tending the machine day in and day out, the roar and buzz and the sharp, jerky noise of the machinery, which is deafening, and, to those particularly sensitive, " nerve-racking."

A bad, unhygienic habit, common to all weavers who tend old-fashioned looms, is that of drawing the filling through the shuttle eye with the mouth. The weaver puts his mouth close to the shuttle, and, by means of a quick intake of breath, sucks the end of the thread through the shuttle eye, thus drawing into his mouth more or less fine lint and dust, which gives rise to spitting, and sooner or later may cause irritation of the mucous membrane of the throat. This practice is especially bad because of the fact that, if out for a day a spare hand substitutes. The so-called Northrup loom is gradually replacing the others. In this loom, after the drum is filled with shuttles, the action is entirely automatic.

Mills visited.

Ninety-three manufacturing establishments, comprising several hundred mills, were visited. In the list which follows, C indicates cotton; D, dyeing; K, knit goods; S, silk; and W, woolen or worsted.

CITY OR TOWN.	Name of Company.	Character of Product.	Number of Employees.
Billerica,	Faulkner Manufacturing Company,	W	-
	Talbot Mills,	W	400
Cambridge,	American Net and Twine Company,	C	350
Chicopee,	Dwight Manufacturing Company,	C	1,700
	Chicopee Manufacturing Company,	C	1,800
Clinton,	Lancaster Mills,	C	2,000
Fall River,	Algonquin Printing Company,	D	350
	American Linen Company,	C	1,000
	American Printing Company,	D	925
	American Thread Company (Kerr Mills),	-	1,000
	Arkwright Mills,	C	500
	Barnaby Manufacturing Company,	C, S	550
	Barnard Manufacturing Company,	C	650
	Chace Mills,	C	650
	Conanicut Mills,	C	175
	Cornell Mills,	C	400
	Davis Mills,	C	400
	Durfee Mills,	C	1,125
	Fall River Bleachery Company,	D	-
	Fall River Iron Works Company,	C	5,000

City or Town.	Name of Company.	Character of Product.	Number of Employees.
Fall River — *Con.*,	Fall River Manufactory (see Pocasset Manufacturing Company).	C	350
	Flint Mills,	C	425
	Globe Yarn Mills,	C	-
	Granite Mills,	C	1,200
	Hargraves Mills,	C	900
	Kerr Mills,	C	1,000
	King Philip Mills,	C	1,100
	Laurel Lake Mills,	C	564
	Mechanics Mills,	C	600
	Merchants Manufacturing Company,	C	1,350
	Parker Mills,	C	350
	Pocasset Manufacturing Company,	C	750
	Sagamore Manufacturing Company,	C	800
	Sanford Spinning Company,	-	-
	Seaconnet Mills,	C	380
	Shove Mills,	C	700
	Stafford Mills,	C	800
	Stevens Manufacturing Company,	C	500
	Union Cotton Manufacturing Company,	C	900
	Wampanoag Mills,	C	800
Fitchburg,	Grant Yarn Company,	C	250
	Nockege Mills,	C	250
	Orswell Mills,	C	350
	Parkhill Manufacturing Company,	C	1,150
Haverhill,	Stevens & Company,	W	185
Holyoke,	Farr Alpaca Company,	-	-
	Lyman Mills,	C	1,300
Lawrence,	Arlington Mills,	C, W	800 3,500
	Atlantic Cotton Mills,	C	1,200
	Everett Mills,	C	1,000
	Kunhardt, G. E.,	W	950
	Lawrence Duck Company,	C	300
	Pacific Mills,	C, W	5,200
	Pemberton Company,	C	750
	Washington Mills,	W	6,500
	Wood Worsted Mills,	W	-
Lowell,	Appleton Company,	C	1,100
	Bay State Mills,	W	600
	Boott Cotton Mills,	C	1,400

City or Town.	Name of Company.	Character of Product.	Number of Employees.
Lowell — *Con.*, . .	Hamilton Manufacturing Company, . . .	C, D	2,500
	Lawrence Manufacturing Company, . . .	K, D	3,700
	Lowell Bleachery, ...	D	350
	Massachusetts Cotton Mills, ...	C	2,300
	Merrimack Manufacturing Company, . . .	C, D	3,000
	Middlesex Company, ...	W	600
	Stirling Mills, ...	W	190
	Tremont and Suffolk Mills, ...	C, W	3,000
Ludlow, . . .	Ludlow Manufacturing Associates, . . .	-	-
Methuen, . . .	Methuen Company, ...	C	350
Millbury, . . .	Cordis Mill, ...	C	150
	Mayo Woolen Company, ...	W	200
	Rice, E. F., ...	C	-
	U. S. Linen Company, ...	-	-
	West End Thread Company, flax, ...	-	-
New Bedford, . .	Bennett and Columbia Spinning Company, . .	C	-
	Grinnell Manufacturing Company, . . .	C	1,050
	Manomet Mills, ...	C	500
	New England Cotton Yarn Company, . . .	C	-
	Pierce Mill Corporation, ...	C	-
	Potomska Mills, ...	C	1,200
	Rotch Spinning Corporation, ...	C	-
	Soule Mill, ...	C	700
	Wamsutta Mills, ...	C	2,200
	Whitman Mills, ...	C	1,500
Newburyport, . .	Peabody Manufacturing Company, . . .	C	150-500
North Andover, . .	Brightwood Manufacturing Company, . . .	W	300
	Osgood Mills, ...	W	100
	Sutton Mills, ...	W	175
Readville, . . .	Readville Cotton Mills Company, ...	C	200
Salem, . . .	Naumkeag Steam Cotton Company, . . .	C	1,500
Saxonville, . . .	Saxonville Mills, ...	W	-
Taunton . . .	Canoe River Mills, ...	C	150
	New England Cotton Yarn Company (No. 2 Mill),	C	-
Waltham, . . .	Boston Manufacturing Company, ...	C	1,100
	Waltham Bleachery, ...	-	-
Worcester, . . .	Daniel's Worsted Mill, ...	W, D	-
	Wachusett Thread Company, ...	C	150

Of these 93 manufacturing establishments, 19 carry on their manufacture under nearly ideal conditions, and 23 under conditions which may be designated as good. The condition in all of these, including, as they do, nearly half of the number of establishments and much more than half of the number of operatives employed, and the condition of the health of those employed, as determined by their appearance, the testimony of the physicians prescribing for them and the vital statistics of the cities and towns where located, raise the hygienic condition of those employed far above "the most unhealthy classes of wage earners," with which hygienists have been wont to associate textile workers, even to a very favorable position among wage earners who are congregated in large numbers within doors.

It would be a source of great gratification if the condition of the minority be raised to so satisfactory a standard. Of these, moderately bad conditions were observed in 35 and distinctly bad in 16 establishments. In all of the two latter classes it seems possible to secure marked improvement in conditions, with not unreasonable expenditure.

In order to make a fair comparison of the mills, the various grades of stock used by different corporations and the age of the buildings have been considered. A study of 12 corporations using fine grade of stock shows that 8 of this number have mills whose conditions are very nearly sanitarily ideal, although some of the buildings are from twenty-five to fifty years old.

Of 15 corporations using medium-grade stock, 2, started in recent years, have buildings which are lacking in general order and neatness, while 5 have buildings, varying in age, in which the conditions are good. Of 5 corporations manufacturing colored goods, the buildings of 1 corporation, erected between 1849 and 1892, show nearly sanitarily ideal conditions; while buildings of another of these corporations, erected about twenty-five years and one year ago, are in very satisfactory sanitary condition. Thus it is seen that some of the oldest mills have not only good but very nearly ideal sanitary conditions.

The conditions in coarse-goods mills are less frequently found to be satisfactory. Of 27 corporations using mainly coarse cotton, 5 have buildings in which the hygienic conditions are satisfactory, while the mills of 13 corporations show moderately bad conditions, and those of 9 corporations have conditions which are distinctly bad.

Illustrations are given below of the various types of mills in which the conditions are moderately bad or distinctly bad, to show the lack of general sanitation, — conditions which can be improved with reasonable expenditure, — and of those in which the conditions are excellent or good.

First, however, are submitted certain facts concerning conditions which may affect the health and well-being of mill operatives.

Conditions as to Light, Heat, Dust, Humidity, Gases, etc.

Poor light is itself a factor of no mean consequence in reducing the physiological resistance to disease. It may be a concomitant of a number of other unsanitary influences which affect the health of the worker, as, for example, in the weaving and spinning rooms; or it may be the principle factor, as in web drawing. Apparently too little thought has been given, in mill construction, to providing for light in accordance with the kind of work to be done in a given room. Many rooms are of old construction, with comparatively low ceilings, small windows and small panes of glass. Some of these rooms are narrow, and admit fair light from the sides; but some are wide, and some are basement rooms, which lack both an ample supply and an even distribution of light.

Aside from the question of mill construction, two important factors contribute to poor light in a large number of rooms, viz.: (1) neglect to keep the ceiling and walls clean and white; and (2) infrequent washing of windows, allowing them to go unwashed in some instances for several years. It is frequently the case that prismatic glass of different kinds and sizes is introduced into poorly lighted rooms; but unless this glass is kept reasonably clean, it is of little value. In poorly constructed and neglected rooms, with or without prismatic glass, artificial light is not uncommonly used even on bright, sunny days in the late morning or early afternoon hours; and in such rooms gas jets are as likely to be found as incandescent bulbs. Even if artificial light is not used until the late afternoon hours, there is then much variation as to the time and method of lighting and the kind of light in use. In some instances the light should be turned on half an hour, or longer, before the engineer sees fit to do so; yet the employees during this time are supposed to continue their work with the same degree of accuracy and rapidity as with good light.

The following kinds of light have been met with, and are recorded in the order of frequency: (1) incandescent bulbs; (2) arc lights; (3) gas jets; (4) mercury vapor lights and electric bulbs; (5) kerosene lamps.

It is a well-established fact that either the over-use of the eyes, or the use of eyes under bad conditions, may give rise to eye fatigue or to eye strain; and many eye specialists believe that at least 80 to 90 per cent. of headaches are dependent upon eye strain.

With these facts in mind, it is impossible to ignore the probability that many individuals working by gaslight, or even electric light, in dirty, unpainted, overheated rooms, with impure air and excessive moisture, for ten hours a day or merely for the last two hours during the day, use up a great deal of nervous energy, and suffer from eye fatigue, or eye strain, and its consequences.

In the weaving and spinning departments there are two distinct causes of possible injury to the employees, viz., (1) insufficient light and (2) dust.

Some employees may be exposed to both sources of injury, although it is not usual to find much dust in a weave room. The department where reasonably good light is important, in which most commonly there is considerable dust, is that of ring spinning. Here, on account of the character of the machinery and the way in which it is placed, there are very commonly dark alleys, so that the work of "finding the ends" becomes somewhat trying to the eyes, particularly in rooms that are poorly lighted.

In both weaving and spinning departments there are a number of other unsanitary influences which may affect the health of the workers, the effects of any one of which are not susceptible of correct measurement. The spinning rooms are often excessively hot; the temperature in the winter months is commonly above 90° F., and occasionally above 100° F. The heat generated by the friction of the machinery in a ring-spinning room is at least sufficient to keep the room at a good spinning temperature in the winter months, provided the room is at a proper temperature on starting in the morning.

Although in the majority of the ring-spinning rooms some means of introducing artificial moisture is adopted, the methods of introducing the moisture vary considerably, while in some rooms no artificial moisture is introduced. In a considerable number of spinning and a large number of weave rooms the means of introducing moisture is by the old steam vapor pot, which many agents say is a detriment to a mill, both because it permits excessive steam and heat, and because the regulation of humidity is practically impossible. In addition, therefore, to poor light and some dust in many of the weave rooms and to considerable dust and poor light in many of the spinning rooms, there is commonly an excess of moisture with unnecessary heat in weave rooms, and excessive heat with frequently undue moisture in spinning rooms. Some spinning rooms have no means of artificial moisture; the air in these rooms is, as a rule, very dry.

A weave room with poor light, unnecessarily high temperature, with some dust and an excess of moisture, is not, from a sanitary point of view, a desirable room to work in; neither is a spinning room with considerable dust flying about, together with excessive heat and either undue moisture or no artificial moisture whatever. Add to these unhygienic influences two prominent factors which enter into health conditions of both weave and spinning rooms, viz., (1) want of cleanliness and (2 lack of provision for a plentiful supply of fresh air, and a class of room is represented which is conspicuously common among the weave and spinning mills in this State.

The conditions found in a certain proportion of weave and spinning rooms may be tabulated as follows: —

1. Poor light.
2. Presence of carbon dioxide and carbon monoxide in the air.
3. Non-regulation of artificial moisture: (*a*) excess of moisture, undu heat; or (*b*) no artificial moisture, excessive heat.
4. More or less dust (" fly," dust from sizing, etc.).
5. Lack of cleanliness.
6. Lack of provision for a plentiful supply of fresh air.

A study of 14 corporations whose rooms were decidedly lacking i general order and neatness shows the above conditions in the weavin and spinning departments in their comparative relations: —

Poor Light.	Products of Gas Combustion.	Excess of Heat or Moisture.	Dust.	Want of Cleanliness.	Lack of Proper Ventilation.
14	6	12	14	14	14

A similar relation holds with reference to the factors mentioned above 1, 2, 3, 4 and 6, in a considerable number of rooms in which the genera order and neatness is " fair " or even " good."

The presence of dust in the air of workrooms is a prominent feature i its influence on health. Aside from dirt and other impurities which ma be in the stock, it is the opinion of recognized medical authorities tha vegetable dusts are markedly inimical to health. Those operatives i cotton mills who are peculiarly sensitive to unhygienic influences ma become seriously affected through the constant irritation of cotton dus or " fly " in the upper air passages, giving rise first to dryness of th throat and later to cough and expectoration. Flax dust is thought to b even more irritating than cotton, while dust in the woolen and silk mill (animal origin) is considered to be less harmful in its effects.

There are many departments in which processes are conducted which expose the employees to dust; but the weaving, spinning, carding and waste rooms illustrate the important unhygienic conditions commonl associated with this disturbing element. In estimating the effects o dust upon health, the following considerations, among others, are to b borne in mind: —

1. Grade of stock used, *e.g.*, quality of cotton.
2. Quantity of dust in a given room.
3. Whether the dust is constant.
4. Type of construction of the room.
5. System of management.
6. Number and kinds of other unhygienic influences present.
7. Means of ventilation.
8. Health and susceptibility of the individual.

In some weave rooms the air is so filled with minute bits of dust as to present a hazy or " smoky " appearance throughout the room, and parts of the room are covered with the small particles which have settled thereon; while other weave rooms are practically free from such dust, there being merely a slight amount of lint or dust of microscopic fineness.

Dust in ring-spinning rooms is more constant and is greater in amount than in weave rooms. In a fine-goods mill, in which a high quality of cotton is used in a properly constructed and well-regulated room, the amount of dust present is comparatively unimportant, from the point of view of health. On the other hand, in a coarse-goods mill, where waste stock is used in a low-studded and generally neglected room, the amount, constancy and character of the dust is such as to suggest the probability of real danger.

While in both weave and ring-spinning rooms there are many unhygienic factors, the principal features of the card room are (1) the amount of dust and (2) lack of proper ventilation and effective means of removing the dust. Cotton dust in the card room varies greatly both in quality and quantity. It is always considerable, owing to the carding process of freeing and cleaning the material. In some mills it is enormous in amount, with considerable dirt as a concomitant. The quantity of dust is commonly sufficient to cause a distinct cloudiness of the atmosphere, which, in a room lacking proper ventilation, is a serious menace to the health of the operatives.

In the assorting or waste room " sweepings " are picked over and the different grades separated. Here may be found numerous kinds of waste and dirt, including that which comes from the floors of the card and spinning rooms, and, of most importance, sputum in large quantities, which may contain the exciting causes of infective diseases of the respiratory tract.

It has long been known that work which involves more or less constant confinement in a dusty atmosphere predisposes to the development of diseases of the lungs, especially of pulmonary consumption; but only in recent years, through the science of bacteriology, has the medical p fession and the public been enlightened as to the specific cause of co sumption, and the method of its dissemination among the susceptib The people of to-day, therefore, in every walk of life, have a far grea responsibility thrust upon them with respect to minimizing this sou of danger by the application of all reasonable sanitary measures. have to bear in mind, then, in considering the dust problem, the pos bility of the presence of "infectious dust" from dried sputum in t air of different mill rooms. Persons suffering from consumption can always be detected in these rooms, and the habit of indiscrimin spitting involves the possibility of infection.

A comparison of the important constant or possible unhygienic i fluences in the ring-spinning and carding departments, with empha upon the dust in these rooms, is as follows: —

Ring Spinning.

1. Considerable dust (constant).
2. "Infectious dust" (dried sputum).
3. Excessive heat (with artificial moisture).
4. Excessive heat (without artificial moisture in some rooms).
5. Lack of provision for a plentiful supply of fresh air.
6. Poor light.
7. Carbon monoxide gas, and excessive amounts of carbon dioxide fr respiration and combustion.

Carding.

1. Dust (abundant and continuous).
2. "Infectious dust" (dried sputum).
3. Lack of provision for a plentiful supply of fresh air.
4. Carbon monoxide gas, and excessive amounts of carbon dioxide fr respiration and combustion.

Having considered some of the larger workrooms with especial ref ence to insufficient light and to the presence of dust, together with oth unsanitary influences, attention should be called to the facts concerni the introduction of artificial moisture.

A special study of 80 weave rooms was made. In 57 of these roo the so-called steam vapor pot[1] system was found. In 18 rooms th was excessive moisture; in 4 of these, excessive heat. In 20 rooms t drosophore or some other modern system (with or without the vap steam) was found, showing that the modern systems are fast gaining ground. In 9 there was excessive heat, and in no one of these 9 rooms was there any attempt to regulate the temperature; in 7 rooms there were no thermometers.

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[1] By this system moisture is usually added to the air of the rooms by means of a numbe steam jets. Steam thus introduced is known in the trade as "live steam." The moisture comes visible just after escaping from the pipe, and again disappears at a distance of 2 or 3 fee

The investigation showed conclusively that scarcely any effort is made on the part of most manufacturers to ascertain the definite conditions with respect to heat and moisture favorable to weaving, by the use of accurate thermometers and hygrometers. The raising of humidity is done in a very unworkmanlike manner. In 23 of the 80 rooms there were no hygrometers; in 2 rooms where hygrometers were present they were broken; and in a large number of rooms one or more hygrometers were found to be unserviceable. In the great majority of instances where hygrometers were used the instruments were untrustworthy. The ordinary stationary wet and dry bulb thermometer for determining the atmospheric humidity is, according to an authoritative writer on this subject, "far from satisfactory for mill use, and except in very careful hands is absolutely worthless." Moreover, most of the men who have the care of the hygrometers either neglect to keep them in order or fail to take accurate records.

Agents or superintendents of a few corporations, on the other hand, have made careful and extensive inquiries in order to determine "what constitutes the best working conditions and what degree of atmospheric humidity for a given temperature will give the best results," on the ground that the information obtained may be, from a commercial point of view, of great importance. These men have used the self-registering hygrometer, or psychrometer, and the "sling hygrometer," with very promising results; and one of them states that, "for quickly and accurately determining the actual moisture and temperature conditions of a room, the sling hygrometer leaves little to be desired for mill use."

That heavy or excessive steaming in mills is injurious to the health of those who work in them has been for years the opinion of competent physicians. On this subject a report of great value was made in 1897 by a committee appointed by the English government. It was this report which made in many respects a new departure in factory legislation. While the amount of moisture allowed in rooms where artificial moisture was introduced had been under government control since 1889, the order of 1898 contained important provisions with regard to the character of the steam introduced into the rooms, in addition to the provisions for the regulation of temperature and the exceedingly valuable provision for ventilation.

Conditions of Toilet and Wash Rooms, with Reference to Location, Ventilation and Privacy.

In the majority of mills the toilet rooms and facilities for washing are beyond criticism, being properly constructed and placed and provided with means for adequate ventilation; and due consideration is given to decent separation of the quarters provided for each sex. In not a few, on the other hand, there is imperative need of improvement as regards structure, location, ventilation and common decency. In a number of instances these conveniences are situated in corners of workrooms, and have absolutely no means of ventilation excepting into the workrooms, the air of which in the immediate vicinity of the closets is noticeably foul, the degree of pollution depending upon general conditions as to cleanliness and care. In a number of mills the closets for the two sexes were found to be separated only by partitions, in which, whether of wood or brick, were many holes of various sizes, some plugged with paper and others not. In one of the largest establishments, some of the women's closets, unprotected by doors, were found to be so placed with reference to the corridor traversed by both sexes that their chance occupants were plainly observable.

Conditions as to Means of Egress in Case of Fire.

Generally speaking, the means of egress in case of fire have been found to be adequate, and in a number of instances most admirable; but in certain cases the possibility of great loss of life in the event of fire is so self-evident as to demand special mention, as follows: —

A. A four-storied brick building, 200 by 80 feet. No outside fire escapes on three sides.

B. Two sixth-story rooms, with no outside fire escapes. Working in one are 63 persons, including 7 girls under eighteen years, and in the other are 48, including 4 girls under eighteen years.

C. Mill with five stories and an attic. From the floor of the attic to the ledges of the windows where the fire escape starts is about 12 feet. An iron ladder is so arranged that it can be lowered to the floor to permit reaching the slanting roof, which is about 90 feet from the ground. From the windows a ladder with rounds which nearly touch the roof leads to the edge of the roof, whence a slanting ladder leads to the ground. In this attic room, about 90 feet from the ground, are 54 employees, mostly women and girls.

D. Two large, sixth-floor rooms, with window sills 5 feet from the floor. In one are 23 boys and girls under eighteen, and in the other are 75 employees, more than half of whom are women. A narrow iron ladder leads from the fire-escape window down the slanting slate roof, the ladder resting on the slates for about 10 feet, and then downward on the side of the building.

Conditions as to Possibility of Injury through Accidents.

In a great industry, employing large numbers of persons in a number of different operations which involve the use of various kinds of fast-running, complicated machinery, the theoretical possibilities of physical injury are obviously great; but in practice the actual casualties are relatively small in number and chiefly trivial in character, as will appear on examination of the following analysis of the accident cases which occurred at the second largest establishment in the State, employing 5,200 persons, during a period of almost five years (lacking four weeks). During the whole of this period the actual number of working days was practically 1,500, and the number of accidents was 1,000, or 4 per working week among 5,200 persons, — a proportion which, it may be fairly assumed, compares favorably with that obtaining in the population at large.

Analysis of 1,000 Accidents which occurred at the Pacific Mills, Lawrence, Mass., during the Period of nearly Five Years, from Aug. 10, 1900, to July 13, 1905.

The record of 1,000 accident cases reported at the Pacific Mills includes many cases of a trivial nature, as is shown by the fact that 99 cases were not considered serious enough to be sent to the hospital, and 37 persons refused to go, mainly because they thought it unnecessary.

But 1 person was killed outright, and but 1 was fatally injured, during the period of nearly five years.

Killed outright,	1
Fatally injured,	1
Seriously injured (broken limbs, or amputation necessary),	86
Slightly injured,	910
Unclassified (suffered nervous shocks, but physically uninjured),	2
	1,000

Were sent to the hospital for examination or treatment,	822
Were not sent because injury was thought too slight by overseer,	99
Refused to go,	37
Went to family physician by preference,	41
Killed,	1
	1,000

Spoke or understood the English language,	794
Did not, or were not fully capable of understanding it,	206
	1,000

Actual Causes of Injury.

Caught in machinery in operation in ordinary usage,	320
Caught in machinery while cleaning contrary to orders,	111
Careless handling of tools or implements of work,	98
Handling machinery, merchandise, etc., in transportation, etc.,	137
Slipped on floors, etc., and were caught by machinery, etc.,	61
Injured by trucks or wagons used in the work,	36
Injured by belts,	32
Injured by splinters of wood or iron,	39
Struck by flying shuttles,	19
Injured while about the elevators,	19
Falls from stagings or elevated platforms,	16
Falls from ladders,	11
Falls down stairs,	11
Falls through trap-doors,	6
Falls on ice, or struck by falling ice,	3
Injured by falling coal, while handling same, or working in coal pockets,	15
Injured by falling shafting,	1
Burned by steam or hot water,	16
Burned by acids or dyestuffs,	8
Cut by glass, putting hands through windows, etc.,	10
Injured on railroad work,	17
Accidents caused by horses,	7
Injured by trenches caving in,	2
Struck maliciously by fellow workmen,	5
Unclassified,	10
	1,000

Underlying Cause of Injury.

Careless manipulation,	539
Deliberate carelessness (taking chances of being injured, such as cleaning machinery while running, etc.),	164
Inattention to surroundings,	177
Carelessness of fellow workman,	51
Unforeseen liability,	60
Unclassified,	9
	1,000

Classification of Injured Employees.

Male,		804
Female,		196
		1,000

Classification by Ages.

Under sixteen years of age,	79	
Sixteen to twenty-one,	246	
		325
Twenty-one to thirty,		302
Thirty to forty,		176
Forty to fifty,		100
Fifty to sixty,		64
Over sixty,		27
Unknown,		6
		1,000

Classification by Nationality.

American birth,		212
Canadian,		271
English and Scotch,		182
Irish,		138
Syrians, Armenians, etc.,		55
Russians, Poles, etc.,		52
German and Scandinavian,		41
Italian, etc.,		31
Portuguese,		18
		1,000

Length of Employment.

Under one month,	143	
One to six months,	275	
Under one year,	124	
		542
One to five years,		255
More than five years,		197
Not stated,		6
		1,000

Place of Employment.

DEPARTMENT.	About Machines.	Not about Machines.	Total.	Hands employed.	PER CENT. INJURED.	
					Total.	Per Year.
Cotton Mills.						
Carding and roving, general,	10	3	13	74	17.57	3.52
Picker rooms,	23	2	25	22	113.63	22.73
Card strippers,	21	-	21	37	56.75	11.35
Frame tenders,	39	-	39	158	24.68	4.94
	93	5	98	291	33.68	6.74
Weaving, weavers,	45	-	45	431	10.44	2.09
Weaving, loom fixers,	3	-	3	48	6.25	1.25
Weaving, loom cleaners,	7	-	7	23	30.44	6.09
Weaving, general,	2	2	4	64	6.25	1.25
	57	2	59	566	10.42	2.08
Ring spinning,	14	2	16	295	5.42	1.08
Mule spinning,	15	2	17	55	30.91	6.18
Spooling and warping,	3	-	3	80	3.75	.75
Dressing and web drawing,	13	-	13	234	5.55	1.11
	195	11	206	1,521	13.54	2.71
Worsted Mills.						
Sorting, combing and drawing,	96	10	106	399	26.50	5.30
Cap spinning,	48	12	60	304	19.74	3.95
Mule spinning,	7	1	8	51	15.69	3.14
Weaving, weavers,	80	-	80	794	10.07	2.01
Weaving, loom fixers,	17	-	17	45	37.78	7.56
Weaving, general,	15	16	31	98	31.63	6.33
	263	39	302	1,691	17.86	3.57
Worsted dyeing and finishing,	49	15	64	595	10.76	2.15
Print Works.						
Shearing and singeing,	4	1	5	32	15.63	3.13
Bleaching, scouring, etc.,	13	3	16	69	23.19	4.64
Drying or white rooms,	8	1	9	77	11.69	2.34
Engraving,	7	2	9	101	8.91	1.78
Printing,	28	6	34	119	28.57	5.71
Color shop,	-	1	1	39	2.56	.51
Steaming and ageing,	10	-	10	67	14.93	2.99
Dyeing and washing,	6	4	10	107	9.35	1.87
Finishing,	9	4	13	109	11.92	2.38
Folding,	8	4	12	164	7.32	1.46
Packing and shipping,	2	10	12	117	10.26	2.05
	95	36	131	1,001	13.10	2.63
Repair Shops.						
About machines,	42	-	42	-	-	-
Handling tools,	38	-	38	-	-	-
Stagings and ladders,	-	25	25	-	-	-
Others,	-	20	20	-	-	-
About engines,	6	-	6	-	-	-
About boilers,	-	11	11	-	-	-
	86	56	142	250	56.80	11.36
Yard and stable,	-	149	149	111	134.23	26.85
Watch,	-	6	6	22	27.27	5.45
	688	312	1,000	5,205	19.21	3.84

Examples of Various Types of Mills with moderately or distinctly Bad Conditions, Susceptible of Improvement with Reasonable Expenditure.

A. Small woolen mill. Walls and ceilings dark and dirty. Basement conditions unsatisfactory. Poor ventilation. Means of removing steam inadequate.

B. Small woolen mill. Walls and ceilings need whitening. Small windows and poor light in low-studded weave and spinning rooms. (To illustrate a simple means of improving light at trivial expense.)

C. Cotton mill, employing 800 persons. Four weave rooms and two spinning rooms are dark, on account of very dirty windows and dingy walls and ceilings. Walls and floor of a mule-spinning room are exceedingly filthy. Ventilation inadequate in the spinning room, and very poor in the weave rooms; in the carding room there are no mechanical means of ventilation and removal of dust.

D. Cotton mill, 800 employees; 145 employees under twenty-one years of age. Age of buildings, thirteen to thirty-four years. Weave rooms, walls and ceilings need whitening to improve the light. Ring and mule spinning rooms, ceilings and walls need whitening. Carding rooms, ceilings and walls need painting or whitewashing. Stairways, walls and windows are dirty and neglected; no system of scrubbing or cleaning; floors very dirty. Very poorly ventilated; no mechanical ventilation in the carding rooms, which are filled with dust.

E. Mill with 350 employees, mostly American born; largest number are girls and women. The processes of spool winding, bobbin winding and knitting of linen thread are followed in a third-floor room, 164 by 71 feet, in an old building. The ceiling is 11 or 12 feet high. About 70 girls and women are in this room, which is poorly lighted and very unattractive. Some time in the past the lower window sashes were said to have been "painted;" to-day the glass presents a worn, dirty, muddy appearance, and keeps out light, which the room needs. (Glass was said to have been painted in order to prevent the employees from looking out of the windows.) More girls in this room wear glasses than in any other room; more look pale and unhealthy than in the other rooms. The walls and ceilings need thorough cleansing and whitening. The slackness, dirt and bad light are unpardonable, and there should be some efficient means of ventilation in a room with so many occupants constantly at work. The room below needs improvement along the same lines. This establishment well illustrates a type of factories which shows like neglected conditions in one or more rooms, — conditions which can be decidedly improved at an entirely reasonable expense with very little difficulty; and there can be no doubt that such simple changes would affect materially the health of the employees.

F. Cotton mill, with 1,400 employees. Weave rooms, mule-spinning rooms and ring-spinning rooms, very dirty walls and ceilings. Poor or bad light in four rooms; low ceilings in four rooms. New treasurer says plans have been made to reorganize the whole set of mills, and declares that the present system by which the work is done, as well as the condition of the workrooms, is wrong; and that clean workrooms, well painted, with new machinery and proper arrangement of departments, are necessary.

G. Coarse-goods mill, employing 3,000 persons. Age of buildings, ten to seventy-five years. Three weave rooms and four mule and ring spinning rooms, low ceilings, poor light, walls and ceilings dirty. Several carding rooms, walls and ceilings very unclean; one room greatly neglected. Picker room dirty, dark and very dusty. Many of the windows very dirty. Many floors old and oil-soaked; some of the weave room floors nasty in places, showing accumulated dirt and water condensed from steam vapor pot system. Stairways need cleaning and whitening. Men, women and children in this mill are exposed to vitiated air, in addition to insufficient light and lack of proper cleanliness.

H. Woolen mill, very old. Weave rooms low studded; lighted by gas; dirty walls and dark ceiling. Mule spinning rooms low studded; lighted by gas; light would be improved by whitening walls and ceiling and cleaning very dirty windows. Warping and spooling room low studded; lighted by gas; walls and ceiling need cleaning and whitening. Carding rooms, walls, window sills and ceilings badly neglected. Stairways dirty and neglected; neglected conditions in most of the rooms. Dirty, even nasty, walls, ceilings, stairways and hallways, — apparently neglected for years, as much of the dirt is in layers, and in corners is in "bunches."

I. A coarse-goods mill, 150 to 500 employees. Buildings erected 1845–90. Three weave rooms, dingy appearance because of lack of whitening ceilings and walls. One room, 11-foot ceiling, is very dirty and dusty, made nasty by the steam from vapor pots. General lack of cleanliness. Small windows. Basement weave room, 8 feet from floor to timbers; ceiling and walls need whitening.

J. Medium-goods cotton mill, employing 200 persons. Original mill built in 1814. Two weave rooms, each 36 by 171 feet, 8 feet high; small windows; ceiling needs to be whitened to improve light; kerosene (glass) lamps hang between looms, suspended by wires from ceilings. Mule spinning room, ceiling less than 8 feet high; ceiling and walls need cleaning and whitening; kerosene lamps; kerosene lamps on movable stands near drawing-in frames.

Examples of Mills operated under Commendable Conditions.

A. Mills, erected 1849–92, where colored goods are manufactured. Number of employees, 1,000. Grade of stock, medium to coarse. General order and neatness, good. In a carding room one "sweeper" and one "scrubber" are kept at work all the time; in a weaving room, two "scrubbers;" in a spinning room, one "scrubber," etc. These persons scrub and keep clean the broad alleys and the spare floor; *i.e.,* where there is no machinery. The floors appear to have continuous and thorough scrubbing. The alleys next to the walls and windows, which in old mills are found commonly to be dirty, are clean. The window sills, also, are kept clean. The water-closets, sink rooms and clothes rooms are orderly and clean. Nearly all the windows are clean; they are said to be cleaned twice a year. The stairways are clean; many women are seen at work scrubbing floors and stairways. Some signs are posted: "Please do not spit tobacco juice on floor or in corners."

B. Cotton mill. Number of employees, 1,200. Grade of stock, fine. General order and neatness, good. Considerable care is taken to keep the rooms clean and in order. All of the rooms in the mills compare favorably with those of modern fine-goods mills, so far as general order and neatness is concerned. Sweepers and scrubbers are kept busy all the time. Weavers do not have to sweep around their own looms. Windows are clean; they are said to be cleaned two or three times a year. The whitened ceilings and walls greatly improve the light in the rooms, besides making the rooms attractive, rather than barn-like in appearance.

C. Modern mill, two years old, for manufacturing combed hosiery yarns. Number of employees, 500. Grade of stock, fine. Height of buildings, three stories and basement. All rooms are 16 feet high, except the basement, which is 12 feet. The walls and ceilings are clean and smooth. The windows are 12 by 7 feet, with transoms. The size of the window glass is 12 by 16 inches. The upper story has monitor windows. Between the carding machines and the combing department is a glass partition. Arc lights are in the picker, carding, roving and mule rooms; incandescent lights in the combing department. Modern humidifiers are installed for regulating moisture in the workrooms. There are separate water-closet towers, including sink rooms, for men and for women.

D. Fine-goods mills, erected in 1871, 1882, 1889 and 1892, in which the conditions from a sanitary point of view are very good. Number of employees, 1,000.

No. 1 Mill, 1871: Top room (spinning), 315 by 87 feet, 15 feet high; equipped with gas. Spinning room, 315 by 87 feet, 13 feet high; equipped with electricity. Upper card room, 314 by 86 feet, 13 feet 8 inches high. Lower card and weave room, 313 by 85 feet, 13 feet 8 inches high.

No. 2 Mill, 1882: Carding and spinning rooms, about 380 by 87 feet, 13 to 14 feet 8 inches high.

No. 3 Mill, 1889: Two weave rooms, about 285 by 96 feet, 15 feet high.

No. 4 Mill, 1892: Two weave rooms, about 400 by 120 feet, 16 feet high.

Nearly all the rooms are light and white (rooms well painted; walls whitened). Sturtevant system of heating and ventilating. Regenerated cold-air system introduced, with vapor steam system. Self-registering hygrometer in use. Some windows have transoms which open; others are so arranged that the top part of the lower sash can be tipped back into the room, — the sides being closed in with wood, — so that fresh air may be admitted into the upper part of the workrooms.

MANUFACTURE OF CARPET YARN, TWINE, CORDAGE AND GUNNY CLOTH FROM JUTE AND HEMP.

The raw material in various forms comes in bales, which are opened and shaken apart, and the contents are then treated according to their nature. Ordinary jute and hemp, after being shaken out, are run through softening machines, in which they are moistened with an emulsion of oil and water, preparatory to carding. Old rope, gunny bagging and twine are run through machines which pick the fibers apart as a preliminary to other processes. Opening, picking, softening and carding are processes which are exceedingly dusty, and the dust is very irritating to the air passages. The machines which straighten and twist the fibers also give rise to much dust.

Three mills devoted to this industry were visited, the largest of which gives employment to about 2,300 persons, including 116 children between fourteen and sixteen years of age, nearly all of whom are girls; and the second in size employs from 200 to 500 persons, according to the conditions of business. In the former the rooms are fairly or well lighted; but all of them, in spite of mechanical ventilation and open windows, are exceedingly dusty, and many of the operatives wear thick bunches of fiber over mouth and nose as a protection. A fairly large proportion of the operatives show the effects of their employment, looking pale and sickly.

In the establishment second in size the light is good, and the ventilation, apart from dust, is fair. The spinning rooms are clean, light and well ventilated. The room in which old rope is picked apart is very dusty, but it is of good size, and is occupied by but 2 persons. The room in which Sisal hemp is fed into breakers has an area of nearly 17,000 square feet for 40 occupants, but the air is filled with dust.

In the third place the rooms are light and well ventilated. In some parts the air contains considerable dust, but the employees in all departments look well and strong.

MANUFACTURE OF CARPETS AND RUGS.

The processes followed in the weaving of carpets and rugs are very similar to, if not identical with, those of the cotton and woolen cloth industries, but there are certain conditions which are different. In the matter of material, for example, there is a wider range, since yarns of hemp, jute, worsted and cotton are employed. Some of these are bought in bale form, and others are made on the premises. Thus cotton comes in rolls, and is carded, twisted and spun into roving; and wool comes in various forms, and requires different methods of handling. In the sorting of wool the material is handled on benches with perforated tops, through which dust and dirt fall to a box beneath. Some of the wool is "picked" by machinery, back of which are small compartments into which the finely picked fibers are blown. The air in the vicinity becomes heavily impregnated with dust and flying fibers.

Such of the wool as may require it is fed into washing machines, which wash it with soap and water, and then into a series of tanks of water. Finally it is passed to drying machines, in which it is dried by heat.

The yarns that come in baled form are opened up and dusted by machinery, which process causes considerable dust.

Carpet yarns are wound on bobbins and on spindles, and this process is commonly a dusty one. They may be sized with a mixture of glue and paste, to impart stiffness; and some of them are passed through a dressing of paste, with or without color, and then are quickly dried and wound on drums or beams.

The operation of carpet weaving is accompanied by much dust, and requires constant attention and keen watching for flaws and "skips" in the weaving. After a carpet or rug is woven, it is inspected, sheared and brushed. The shearing machines cut off all bits of fiber and other irregularities, and in so doing create considerable dust, much of which is coarse and heavy, and does not long remain suspended in the air.

Five carpet factories visited employ about 6,000 persons, about 10 per cent. of whom are between the ages of fourteen and sixteen. The largest of these shows some departments in which poor light, excessive heat, moisture and dust constitute the objectionable conditions. One large, fairly well-lighted room, 220 by 120 by 16 feet, and occupied by 33 persons, has so much fine cotton dust and fiber in the air that it is with difficulty one can see across it. This dust is very irritating to the nose and throat.

Some of the rooms are poorly lighted, some are overheated and some are badly ventilated; and one large basement room, 285 by 60 by 13 feet, occupied by 150 women and girls winding yarns on bobbins, combines all three of these objectionable conditions.

The wool-picking room is well lighted, but the air is heavy with wool fiber, and is at the same time excessively hot.

One large dusting machine is equipped with a fan and exhaust dust pipe which never have been used; indeed, there is no shafting to run the fan. The machine has been in use upwards of five years, and the person who operates it has worn a handkerchief over nose and mouth ever since it was started. The work is exceedingly dusty and dirty.

The weaving rooms of the next largest of the 5 factories are large and well lighted, but the air contains a noticeable amount of dust. Most of the departments of this mill show commendable conditions.

In the third many of the children between fourteen and sixteen are very small and poorly developed for their age, and are far too poorly developed to be allowed to work ten hours and twenty minutes for five days in the week.

In many rooms the windows are too far apart, and the light is barely sufficient, even in good clear weather. The older weavers complain of failing eyesight, due to working with poor light.

One of the mills of this establishment, although comparatively new, is poorly lighted in the picking, carding, winding, drawing and roving rooms, but otherwise the conditions are good. In four of the weave rooms the ventilation is very inadequate, the light is poor and the air is very dusty.

The fourth establishment in order is, in the main, poorly lighted and inadequately ventilated, and the weave rooms are very dusty. In four rooms in which yarns are dressed the steam boxes are so loosely constructed that much steam escapes, and causes extreme heat and moisture. About one-tenth of the employees in this establishment look sickly.

The smallest factory of all, one which employs ordinarily 500 persons, has good light, adequate ventilation and commendable weave rooms. The employees appear to be in good health.

MANUFACTURE OF SHODDY.

Shoddy is made from woolen rags, which come ordinarily to the mill in the form of bales. The first process, after the bales are opened, is that of sorting, which is done by women, who pick out all cotton rags, silk mixtures, buttons and other foreign matters. The selected rags are treated in a large vat with dilute sulphuric acid, which attacks and destroys all cotton fibers which may be present, and then they are removed from the bath and allowed to drain. Next they are spread on racks over steam pipes, and dried at a temperature of about 100° F. in a confined space, which, before the dried rags are removed each day, is thoroughly ventilated by opening the windows and operating a blower, so that the men who do the work may not be exposed to the fumes. The rags are next washed, and then are picked apart by machinery. The product is a pure wool of short fiber and very clean, which is sold either dyed or undyed.

Two establishments of this class were examined, one of which is poorly lighted, inadequately ventilated, dusty and ill-kept; the other is light, clean and well ventilated. Some of the women employed appeared to be in poor physical condition.

MANUFACTURE OF FELT CLOTH FROM COTTON AND WOOL.

In the manufacture of felt cloth from cotton and wool processes vary somewhat in different mills, but the chief ones are essentially the same. In the picker room different kinds of wool and wool waste, mixed or not with some cotton waste, are put through a "mixer" and a "burr picker." In this department much dust arises, especially when cotton waste is used to a considerable extent.

The material is brought into the carding room in the form of "laps." The carding room is very dusty, but heavy wool stock gives rise to less dust than cotton and wool together. The loose cloth stock is pressed together in order to make a thick, compact sheet. This process is called hardening and fulling. Then it goes through large wooden rolls to be washed, and to the hydro extractor. In the dyehouse the colors used are chiefly anilins, which are dissolved in large wooden vats in hot water. The cloth is introduced and made to run over drums until colored. From the dyehouse the cloth goes to the drier. In the finishing room the goods are pressed, rolled and baled.

Six establishments of this class were examined, and in all of them the work was found to be conducted in fairly lighted, and, apart from dust, adequately ventilated buildings. In each there was more or less dust, especially in the picking and carding rooms; but the amount was much diminished in most of them by means of blower fans.

CIGAR AND CIGARETTE MAKING.

In the preparation of tobacco leaves for the manufacture of cigars they are moistened with water, then allowed to dry again to the stage desired, and then are spread out by women, who "strip" the stems away; they are next dried again to the desired extent, and are then ready for use. Tobacco must be kept at a certain degree of dampness, in order that it may lend itself properly to the necessary manipulation; and it is kept in covered cans, to prevent excessive drying.

When the cigar is rolled, and the wrapper is applied and fastened with gum tragacanth paste, it is cut at the outer end to the required length, and is then ready for the drying room. In the drying room the cigars are dried, sorted according to color, boxed and labelled.

In the manufacture of cigarettes the baled tobacco leaves are first separated from one another, and the different kinds are then mixed on the floor in a long, low pile, and swept together with a broom. From time to time, as more tobacco is added, the pile is sprayed with water. After standing several hours to "blend" the material is taken to the

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The number of cigar and cigarette factories visited is as follows: cigars, 134; cigarettes, 11. These are situated in Acton (1), Boston (80), Cambridge (3), Chelsea (10), Everett (1), Fall River (1), Fitchburg (5), Hyde Park (2), Lawrence (8), Lowell (4), Lynn (4), Malden (1), New Bedford (2), Newburyport (1), Somerville (4), Southbridge (1), Springfield (1), Waltham (3), Westfield (9) and Worcester (6); and they include establishments of all sizes, from those employing less than 5 persons to those with many hundreds.

As regards light, ventilation and general sanitation, the reports of 127 establishments are from "fair" to "good," and in 18 the general conditions observed were moderately or distinctly bad. But in this industry, as a whole, certain highly objectionable practices prevail very extensively. The spitting habit, for example, is especially common; and, apart from the danger to which the health of the employees is thereby exposed, is particularly to be deprecated, in view of the fact that in the processes of manufacture considerable tobacco falls to the floor, and these fragments, if not gathered up and used on the premises, are very commonly swept up with all the dirt, dried sputum and other matter, and sold as fillings for cheap cigars.

A still more objectionable practice is that of finishing cigars with the aid of saliva. This was observed in more than one-third of the places visited. Attention was called to this habit in the report on industrial conditions, made to the Legislature in January, 1905, which contained the following statement: —

> The possibility of disseminating loathsome diseases through this practice needs no extended discussion. Perhaps it would be fair to say that it is uncertain how long the germs of certain diseases which might appear to be transmissible in this manner may retain their vitality in contact with moist tobacco, but the idea is sufficiently revolting on æsthetic grounds alone.

In 18 factories the practice of biting off the end of the filler and inner wrapper with the teeth was also observed.

In a number of factories there was much overcrowding, some were very dusty, some very dirty in every part, and some extremely hot and foul smelling. A fairly large proportion of the employees look pale and sickly, and in some of the largest establishments this proportion was noted as about one-tenth.

In about one-tenth of the factories the water-closets were noted as being "unclean," "offensive" or "filthy."

CHAIR MANUFACTURING.

The largest of the 9 chair factories visited employs 1,451 persons, the smallest employs but 8; the total number of employees in the 9 establishments is about 2,600.

The woodworking machines employed are run at high speed, and in general are well guarded. They create much dust and large amounts of shavings and chips, but many of them are equipped with exhaust fans and dust flues which lead to the furnaces. The dust which escapes into the air is not especially fine, and, while it settles to a considerable extent upon the operatives, it appears to cause no great discomfort.

In the manufacture of chairs from rattan the material is bleached with sulphur fumes and treated with quicklime and chlorine; but those engaged in the several processes assert that, although the work is somewhat disagreeable, they are conscious of no impairment of health therefrom. The dust arising from the shaving machines, which are fed largely by young women, causes very little irritation and no complaint.

In all of the establishments visited (situated in Gardner and Wakefield) the conditions as to light and ventilation were found to be fair or good; the toilet arrangements were, with one exception, fairly commendable; and the employees showed, as a rule, a healthy appearance. In but one did the spitting habit show itself to a considerable extent, and in one were posted notices prohibiting the practice, under penalty of a fine of $5.

In the largest of the establishments, in which 1,451 persons were employed, but in which the number sometimes reaches 1,700, the largest number of accidents in any one of the years 1899–1905, inclusive, due to the fast-running machinery, was 34; in one year (1901) the number was but 7. The accidents are due to flying pieces of imperfect wood, and to inattention due to the monotony of feeding the machines.

WHIP MAKING.

In the manufacture of whips various materials are used, including heavy rawhide, East India buffalo hide, rattan, wood, glue, cotton thread, paper, anilin dyes, varnish and others. The machines employed in splitting rattan, turning and tapering rattan and wood, give off considerable dust in spite of their equipment with blowers and dust flues; but the workmen assert that the dust is not especially irritating or troublesome. The machines which plait and those which wind the whips with paper and thread create no dust.

Eight of the 9 factories visited were noted as being fairly well lighted and ventilated, and equipped with hoods and blowers; and in all the appearance of the employees as to health was good. In the largest, which employs 200 men and 65 women, there was much spitting on floors and stairways; in 4, the habit appeared to prevail to some extent, especially in 1 employing about 150 persons, about one-third of whom are women; in the others no spitting was observed.

Manufacture of Mouldings and Frames.

In the manufacture of mouldings and frames all the several processes are accompanied by much dust, or by the fumes of wood alcohol. If the woodworking machinery is well protected and provided with hoods, by far the greatest part of the shavings and dust is taken away.

Bronzing is also a dusty process, and those who engage in it uniformly refuse the use of respirators. In the 4 moulding establishments visited the woodworking machinery was found to be well equipped with exhaust ventilation, which conveyed the dust and shavings to the boilers. In 3, where the operation of bronzing is carried on, there was considerable bronze dust. In 1 the fumes of wood alcohol were very strong, in 1 moderately strong, and in a third only perceptible.

In the largest of these establishments 60 persons are employed; in the smallest one, 2. In the latter there was very little business, and correspondingly little machinery.

The Boot and Shoe Industry.

Second only to the textile industry, as a whole, but of greater commercial importance than either of the chief divisions of the same (cotton and woolen manufacture) alone, stands the boot and shoe industry. According to the census of 1900, while the value of the textile production of Massachusetts was $213,000,000, including $110,000,000 for cotton and $73,500,000 for woolen goods, that of the product of her boot and shoe factories was no less than $117,000,000. As in the case of textiles, so with boots and shoes, Massachusetts leads all other States, — indeed, she manufactures nearly half the shoes produced in the whole country, — Massachusetts, $117,000,000; all other States combined, $135,000,000. The nearest competitor, New York, produces but little more than one-fifth as much as does Massachusetts.

In this enormous industry many thousands of persons are employed in a large number of factories in many cities and towns in all parts of the State; in 3 cities it is the leading industry, and also in a number of towns. In the course of this investigation 373 factories, situated in the following cities and towns, were visited: —

Cities.

PLACE.	Number of Factories.	PLACE.	Number of Factories.
Beverly,	12	Lynn,	120
Boston,	1	Marlborough,	7
Brockton,	43	New Bedford,	1
Chelsea,	8	Newburyport,	8
Everett,	2	North Adams,	3
Fitchburg,	2	Peabody,	1
Haverhill,	65	Pittsfield,	2
Lawrence,	1	Salem,	8
Lowell,	6	Worcester,	7

Towns.

Abington,	3	Natick,	9
Athol,	1	Randolph,	3
Braintree,	3	Reading,	1
Conway,	1	Rockland,	5
Dalton,	1	Spencer,	2
Danvers,	3	Stoneham,	2
Framingham,	1	Stoughton,	3
Georgetown,	4	Wakefield,	1
Holbrook,	1	Wayland,	2
Hudson,	4	Webster,	2
Marblehead,	13	Weymouth,	4
Middleborough,	3	Whitman,	2
Milford,	2		

The factories visited include many of small size, as well as the largest and most modern establishments in the State. The investigation shows that even in the smaller and older establishments as much care can be and is given to the health and comfort of the employees as in the very best of the largest.

The processes involved in the manufacture of boots and shoes are numerous and exacting, and some of them are accompanied by conditions which, unless care be taken to prevent their full influence, may cause injury to the health of the operatives. For a proper understanding of the hygiene of the industry the following description of the work of the various departments is presented: —

Cutting Department.

In the manufacture of shoes the first process is that done by the "cutters," who cut the leather, on a specially prepared board, with sharp knives, and inspect it carefully to detect imperfections, which work calls for good light.

In certain kinds of shoes the material which is to form the "upper" is taken to the crimping machine, which stretches and curves the leather so as to make it more like the "last" in shape, and later it is cut again.

This work is carried on generally in a large room in conjunction with a number of related processes, which, according to their nature, call for the services of men or boys, women or girls. The cutters are men, as are also the lining cutters, who are comparatively few in number, one being able to cut linings for many cutters. The size and case number are stamped on the linings by women or young men, who may sit while at work.

The reënforcement of parts with cotton cloth is done by machines attended by boys or girls, who may stand or sit, as they like.

The remnant pieces from the operation of cutting are saved for "tongues" and "eyelet stays," which are cut by boys and young men with dies and mallet. Trimmings for sock linings are cut from sheepskins or split sheepskins, known as "skivers," by men, who stand at their work.

The "tips" are perforated by machines operated by young men, who may sit or stand, at will. The edges of the leather are blackened by boys or young men with a mixture of naphtha and lampblack, only a small quantity of which is kept in the building, the main supply being kept elsewhere.

Before going to the stitching department the "outsides," linings and trimmings are "booked."

Stitching Department.

In the stitching department, as in the cutting department, men, women, boys and girls are employed. Before the parts of the shoe are put together the lining is joined together by a stitching machine, and is then trimmed and stitched to the "outside" by means of the "closing-on" machine, both of which machines are operated by women. Processes vary according to the kind of shoe.

The edges of the vamps, quarters, tips, etc., are covered with a cement made of rubber and naphtha, which is kept in small bowls on the benches in front of the employees (women and girls), who naturally are exposed to the fumes of naphtha arising therefrom. Several grades of cement are used; the cheaper grades, which give off the more disagreeable fumes, answer all of the requirements of the stitching department, but for sole-laying and cementing channels they do not give satisfaction. The cemented parts are allowed to dry, and the edges are then turned over by pressing machines, which give a finished appearance.

The shoe is put together by stitching the vamp to the quarters. This is done by both men and women, and is work which demands much care. Several different processes are followed, according to the kind of shoe, the heavier work being done by men. Machines for eyelets are operated generally by men, but those for buttonholes are run by women.

Sole-leather and "Stock-fitting" Departments.

In the sole-leather and stock-fitting departments the stock is "got out" by being cut into shape, channelled, etc. This work is done by men. The resulting soles and the finished uppers now go to the "making" department.

Making Department.

The making department includes several divisions, known as lasting, heeling and finishing, which in turn include many sub-divisions. The employees are men and boys, and the work is mainly "standing" work. Only eight of the processes are of any especial sanitary importance, from the fact that the conditions regarded as essential may affect injuriously the health and comfort of the employees. These are: —

1. Heel trimming or shaving.
2. Edge trimming.
3. Buffing.
4. Naumkeaging.
5. Heel scouring.
6. Breast scouring.
7. Polishing.
8. Cleaning upper.

1. *Heel Trimming or Shaving.* — The heel-trimming machine has two knives, which revolve from 4,000 to 7,000 times per minute; these remove the rough part of the heel. One of the machines is especially adapted to the "heel seat," the knives being so made that they can cut around this portion of the shoe.

The workman must exercise great care to do the work properly, and avoid injury to his fingers. He stands in front of the machine, which is about 4 feet high, and in order to see every portion of the heel he must bend his head and shoulders forward. Because of the swiftly revolving knives, he grips the shoe tightly with his left hand over the heel and his right over the toe. The work causes circular or oval-shaped callosities of varying thickness on the outer and upper aspect of the last two joints of the left forefinger, and commonly also of the middle finger of the left hand. Gloves made especially for this work are said to interfere with rapid handling and, because of the wear and tear which they suffer, their constant use is considered expensive. The constant standing is favorable to the development of the condition known as "flat foot," which is not uncommon among these workers.

The machine has a pipe and exhaust draft system, designed to draw the dust away from the workman's face, which is commonly brought within 7 or 8 inches of the knives.

This work is "piece work," and the employees average about 600 to 700 pairs per day.

2. *Edge Trimming.*—The machine for trimming the edges of the sole contains a circular knife, composed of a number of cutters, which makes several thousand revolutions per minute. Knives of different shapes are used for different edges.

The workman, who sits at his work, after shaving the sole of one shoe must shave the edge of that of its mate to a corresponding width. This requires good light, accurate eyesight, considerable skill and close attention. The process causes varying amounts of leather dust, the finest of which, in well-equipped factories, is sucked at once into a pipe, attached near the cutters, by a strong exhaust draft, and carried to the dust-room or to the outside of the building.

3 and 4. *Buffing. Naumkeag Buffing.*—In the process of buffing, the sole is brought in contact with a revolving roll, composed of paper, cloth and carborundum, which gives a result similar to that of sandpapering. Very much fine dust is caused, and, unless the machine is equipped with a powerful exhaust-draft dust pipe, the workman's face, especially if he be short of stature, is much exposed thereto. The distance between the face and the revolving roll varies from 5 to 10 inches.

Naumkeaging or Naumkeag Buffing.—The Naumkeag machine reaches that part of the shank which the rotary roll of the buffing machine cannot touch, and it scours, brushes and smooths the leather with corborundum for the staining process in the finishing department. The dust which arises in this process is very fine, but is less in amount than that caused by buffing.

5 and 6. *Heel Scouring. Breast Scouring.*—In heel scouring a felt wheel is used, covered with carborundum, moulded paper and cloth. The process gives rise to more or less dust, which, in the main, is carried

down inside the machine by a suction draft. Breast scouring is done with a conical carborundum wheel which gets up under the shank. This machine also is connected with an exhaust blower designed to carry the dust away from the worker's face.

7. *Polishing.* — Polishing is done with revolving bristle brushes and cloth wheels. Blacking is applied to the shoe bottom, wax is put on the brush or wheel, and the bottom of the shoe is held against the brush or wheel, which revolves with great rapidity. More or less fine dust arises, consisting of wax, lint and blacking.

8. *Cleaning Upper.* — The last process in the making department, previous to stamping and pulling off the last, is that of cleaning the upper with the "Webster cleaner" machine. A tank of water connects by means of a large wick with the surface of a rapidly revolving bristle brush, which takes up the water and conveys it to the shoe, which is then wiped with a seersucker brush, the edges of which constantly wear off, causing much lint dust to fly into the air. The men who do this work are usually black from head to foot, and the wall near the brush becomes plastered with black lint.

Packing Department.

In the packing department several processes are conducted, among them "treeing." The "Miller treeing machine" has "tree legs" and "tree feet," upon which the shoes are fitted closely for the ironing or "treeing" process, which is done by irons heated by electricity or gas, and operated by men, who stand at their work. Here, also, women sit at benches repairing tips cracked in the process of making. The packing is done by men.

Conditions observed.

Light. — In the various processes of manufacture good light is essential to good work, and in the great majority of the factories visited the report as to this condition is favorable. In 50 establishments the lighting of certain rooms was found to be barely fair, or poor, and in 26 it was distinctly poor, or even bad.

Good light is especially important with edge-trimming machines, and in most factories these are well placed. With good light the operative does not have to bend so closely over his work, and consequently is not so much exposed to the influence of the dust produced.

A not uncommon arrangement of some machines places them so that they face the light, which in some processes necessitates bending over the work, or raising of the hoods, so as to see well, with consequent increase in the amount of escaping dust.

Of the poorly lighted rooms, the air in 35 was noted as not only foul, but containing much fine dust or lint.

Ventilation. — In the majority of the factories visited the ventilation was found to be poor, or distinctly bad; and in most cases where these conditions obtained, there was excessive heat. Where the ventilation is poor, the air becomes much worse toward night; and in some cases it is so bad that the employees assert that they are sometimes nauseated on entering the workrooms in the morning. These are usually long and narrow; and if, in cold weather, the windows are opened, cross-drafts are established. Some foremen say that, while they would be blamed were employees to complain that they had taken cold from open windows, they are not blamed by employees for sickness due to vitiated air and overheating. Crowding of rooms with machinery and stock facilitates work by shortening the distances through which the shoes have to travel in the processes of manufacture; and it is asserted that more cubic space per capita would involve a considerable addition to the general expense of maintenance.

In 103 factories strong odors of naphtha were observed. In some establishments it was said that the odors are so overpowering that the girls who handle the naphtha cement become nauseated, and suffer from headache. Some of the naphtha cements cause much more trouble than others. In 24 factories fumes of wood alcohol were plainly observable.

In a certain number of rooms strong odors of naphtha were noticed, in addition to wood alcohol fumes. In 74 of the many unventilated rooms, some of which were overcrowded and overheated, the employees were exposed to strong fumes of naphtha or of wood alcohol, or of both. As stated elsewhere in this report, wood alcohol fumes are a very real danger to health, and especially to sight, not infrequently causing total blindness; but no instances of trouble arising therefrom were reported in the investigation of this industry.

In one room, occupied by 110 persons, including 10 girls and women, using naphtha cement, the odor of naphtha was very strong; the air was otherwise distinctly foul, and the heat was excessive. In addition, the light was so poor that at 11 A.M. the gas was being burned. In many other rooms occupied by women and minors there was no attempt to ventilate, and the air was overheated and heavy with naphtha fumes. In one all of the 12 girls engaged in the use of cement were noticeably pale.

In some factories a patent can is used, which prevents waste by evaporation, and hence diminishes the fumes of naphtha and wood alcohol. It has a spring top, which is pressed down, and closes when the finger is removed.

Of the rooms in which dust is not an important factor (stitching, cementing and cutting), no fewer than 102 were found to be badly ventilated and 26 to be overcrowded.

Removal of Dust. — The rooms in which large amounts of dust are evolved are those in which the operations of heel trimming, edge trimming, buffing, naumkeaging, heel scouring, breast scouring, polishing and upper cleaning are conducted. For effective removal of this dust, exhaust flues attached to the machinery are necessary. Of the 373 factories visited, 126 are partially, and a fair proportion of these are wholly, equipped with this means of protection to the workmen; in 88 of these 126 one or more machines are not so equipped; and in 49 of the 88 there are rooms in which the air, apart from the escaping dust, is noticeably bad.

The number of machines with means for efficient or fairly efficient removal of dust was found to be 1,630; the number either inefficiently equipped or devoid of equipment was reported as 2,769.

The reasons for inefficiency include improper adjustment of hoods, clogging of pipes, leaking pipes, bad connections, poor draft, small openings, small pipes, improper position of machine with reference to light, necessitating the raising of hoods in order to see well. It appears, however, that a machine may be fairly effective in dust removal with one kind of work, and faulty with another; and that, while with some kinds of material a well-equipped machine may give off some dust, with other material a machine without exhaust drafts may create little, if any. Again, in edge trimming much less dust is produced when light and thin-soled shoes are made; and, further, it not infrequently happens that, owing to changes in styles of shoes, it becomes necessary to introduce machines into places where such were not originally intended to go, or processes are modified so that machines which worked unobjectionably before give off much dust when employed on a different kind of material. Thus it happens that in certain factories, in which there is an evident intention to have all conditions perfect, a set of machines may be found whose running is attended by objectionable conditions. It is only fair to state that in one city (Marlborough) nearly all of the factories have unusually good dust-removing machinery, and that the results are generally most commendable.

Of 84 of the many unventilated and dusty rooms reported in the course of this investigation, 40 were overcrowded, 35 were dark, 21 were overheated; and 18 were overcrowded, dark and overheated.

Water-closets. — In 135 of the factories visited the conditions as to water-closets were found to be not commendable. In most of this number the closets were dark and dirty to very dirty. In one of the centers of this industry many of the closets are built directly in the middle of the workrooms, and are wholly unlighted; and leaking pipes are not uncommon.

Health of Employees. — While in general the health of the employees appears to be fair to good, in 85 factories a considerable proportion of them are noticeably pale and unhealthy in appearance.

The Spitting Habit. — In all but 50 of the 373 factories examined the habit of spitting was noticed to obtain to a greater or lesser extent. In 35 the report is "much;" in 115 it is "considerable;" in 173 it is "some."

The Noon Hour. — In the great majority of factories the time allowed for the mid-day meal and rest is one hour; in 21 it ranges from 65 to 75 minutes; in 40, from 45 to 55 minutes; in 13 it is but a half hour. In a large proportion many employees do not leave the premises, but eat in the workrooms, taking little if any time for change of air. In some, lunch rooms are provided, where the employees may eat the luncheons which they have brought with them, or buy according to their desires and means.

Employment of Minors. — In 47 of the 373 factories a considerable number of the employees look to be about fourteen years of age, and in 14 of them the proportion of minors is large. Many of this class are noticeably pale and poorly nourished, and show the effects of the unhygienic influences to which they are subjected. Many appear to be about twelve years of age, but have certificates that they are sixteen. If true, these boys are singularly undeveloped, and, if they are allowed to continue working in factories, will probably become public charges at no late day.

General Conditions.

Owing to the complex set of facts reported, an accurate comparative classification of factories, from an hygienic point of view, cannot be made; but a list of 62 factories was reported on the same basis, as showing absolutely satisfactory hygienic conditions. In 91 the conditions were unsatisfactory; in 72 they were poor; and in 19 they were distinctly bad.

Examples of Factories with Moderately or Distinctly Bad Conditions, Susceptible of Improvement at not Unreasonable Expense.

A. About one-tenth of the employees look unhealthy. In two rooms, occupied by 45 and 70 persons, respectively, no attention is given to ventilation, and the air is very bad.

B. Room with 40 occupants, overcrowded, overheated, unventilated; much spitting. Room with 30 occupants, overcrowded and unventilated. Room with 70 occupants, overheated, unventilated, and smelling of naphtha.

C. In an overheated, somewhat crowded room, 35 girls and women are exposed to strong fumes of naphtha and of wood alcohol. In another room, occupied by 60 persons, there is excessive heat, and no provision for ventilation. Much spitting on floors.

D. Among the employees are a number who appear to be under fourteen years of age. Twelve girls are exposed to fumes of naphtha and wood alcohol. Twenty-six men exposed to much dust. Ventilation in general very poor.

E. Five rooms, overcrowded, dark, dirty, unventilated and dusty, occupied by 312 persons. Much spitting. Water-closets dark and filthy, causing stench in workrooms.

F. Employees include 8 children who are apparently below fourteen years of age. Two rooms, occupied respectively by 50 and 80 persons, overcrowded, unventilated, and one of which is so dark that gas is burned all day. Water-closets dark and dirty.

G. From 5 to 10 per cent. of the employees look sickly, most of them polishers, scourers, edge trimmers, and girls in the stitching rooms. Room with 100 occupants, overcrowded, overheated and unventilated. Three rooms with no ventilation; two overcrowded, and one so dark that gaslights are required at 2 P.M. on a bright, sunny day. Water-closets dark and dirty.

H. About 10 per cent. of the employees appear to be in poor physical condition. Room with 75 occupants, overcrowded, overheated, unventilated and badly lighted. Room with 50 occupants, dark, dusty, and with foul air. Two rooms with 20 and 12 occupants, respectively, dark and poorly ventilated. Room with 100 occupants, overcrowded, overheated, badly lighted. Water-closets dark and dirty.

I. About one-fifth of the employees are below twenty-one years of age, and not a few between fourteen and sixteen years. Room occupied by 130 persons, overcrowded and badly ventilated. Twelve scouring and buffing machines facing the light have covers removed, so that the dust escapes into the room and flies into the faces of the operatives. Room occupied by 159 persons, chiefly women and girls, overheated and unventilated. Much spitting on floors.

J. About 10 per cent. of the employees in the stitching and making rooms look unhealthy. Room with 110 occupants, dark, gaslights burning at 11 A.M., crowded, overheated, unventilated, with strong odor of naphtha. Room with 50 occupants, 6 of whom are boys about fourteen years of age, very dusty and badly lighted. Three basement rooms, so badly lighted that gas is required all day, and badly ventilated. Water-closets dark, very dirty and unventilated.

K. Fully one-tenth of the employees are noticeably pale and in poor physical condition. Room with 140 occupants, poorly lighted, much overcrowded, overheated, unventilated, and with strong odor of naphtha. Water-closets dark and dirty.

L. At least one-half of the employees look pale and in poor condition. Rooms dark, dirty, unventilated. Water-closets dark and dirty.

M. About one-tenth of the employees seem to be in poor health. Several weak-looking boys exposed to strong odors of wood alcohol. Room with 60 occupants, crowded with stock, air bad, and strong odor of naphtha in various parts. Room with 75 occupants, overcrowded, overheated, unventilated. Room with 50 occupants, crowded with stock and machinery, air foul and dusty. Nearly all of the water-closets dark and dirty.

N. Throughout the building the air is poor. The system of indirect steam heating is in use, and the air is drawn from the workrooms and heated and sent back again constantly. The only intake for fresh air is in the basement, where drainage from the sole-leather department causes disagreeable odors. Water-closets are dark and dirty. About one in ten of the employees appears to be in poor health.

O. Room with 50 occupants, several under eighteen years of age, very hot and air very foul. Much spitting on the floor. Some of the machines give off a great deal of fine dust. More than half of the cubic space in this room is taken up by stock and machinery. Room with 130 occupants, so crowded with people, stock and machinery that locomotion is difficult. No ventilation is attempted, and the air is foul. The room is overheated. There is much spitting. Ten girls at work with rubber cement, and the odor of the naphtha adds to the discomfort. In all the rooms of this factory there is excessive heat, and the air is foul. The water-closets are dark and dirty.

P. The windows are opened a short time before 7 o'clock A.M., but remain closed for the rest of the day, owing to fear of drafts. The room is crowded and the air is bad, and there is considerable trouble from dirt sifting down through the cracks in the floor above. Two other rooms, with 60 and 65 occupants, respectively, are crowded, overheated, dirty and unventilated, and there is much spitting on the floor. The water-closets are dark and dirty, in spite of an assessment paid to keep them clean. They are in poor repair; there is leakage from upper floors into the closets and sinks on the lower floors.

Q. A number of the employees in the stitching department are noticeably pale. In one room in another department, poorly lighted, overheated and unventilated, the exhaust pipes have been removed from six of the polishing machines, and a large amount of dust and dirt is thrown into the air. In different parts of the building are machines provided with exhaust drafts, which do not bring about the desired result. Parts of each floor are crowded, dark and dirty, and there is much spitting. The water-closets are dark and dirty.

R. Room occupied by 150 persons, who depend upon one sink, 12 by 24 inches, and one faucet, for drinking and washing facilities. There is a dark, dirty and wet water-closet, 2½ by 5 feet, in centre of the room, with two doors, Another room, occupied by 90 persons, is poorly lighted, overcrowded, overheated and not ventilated. The basement is dark and wet, and the men working there look unhealthy. The factory as a whole is dark and dirty, and the general conditions are bad. In another building a large proportion of the employees are minors, 17 of whom are below sixteen years of age. Room with 195 occupants, and another with 140 occupants, both crowded and unventilated, and one overheated and poorly lighted.

S. Room with 120 occupants, exposed to much fine dust; 20 men exposed to strong fumes of naphtha and wood alcohol. Some of them are noticeably pale, but all of them have become accustomed to the smell. Another room, with 120 occupants, overheated and not ventilated. Much spitting on the floor. Some of the women and about one-half of the minors of both sexes look pale and poorly nourished. Basement room, with 30 men, boys and girls, poorly lighted. The girls are exposed to strong odor of naphtha, and they are noticeably pale. Room with 285 occupants unventilated and overheated, in which a dozen girls are exposed to an unusually strong smell of naphtha; and, though they are noticeably pale, they say they have become used to it. Floors are dirty, and there is much spitting. Some of the rooms are poorly lighted. The water-closets are very dirty, and some are dark.

T. An unusually large proportion of boys and girls, many of whom seem to be in poor health. Rooms overheated, dark, and in need of ventilation. Boys exposed to strong naphtha odors. Water-closets dark and dirty.

U. Among the employees are 3 boys, apparently about twelve years of age, who are said by the proprietor to be in the employ of the men in one of the rooms. Several rooms are very dirty, overcrowded, overheated and dark. The water-closets are dark and dirty.

V. Unusual number of children, apparently fourteen years of age or less; 3 or 4 boys appear to be about twelve; all have certificates, however, stating their age to be sixteen. They are hired and paid by the workmen in various departments. If the statements in the certificates are true, the boys are abnormally small and undeveloped, and ought not to be employed in factories.

W. About 15 per cent. of the employees look poorly. The pay roll carries the names of 80 children under sixteen; the total number of minors is about 250. Room with nearly 200 occupants, overcrowded, unventilated; 20 of the occupants are under eighteen, and 6 or 8 appear to be under fourteen. Other rooms, with from 55 to 150 occupants, some of them children apparently under fourteen, overcrowded, badly lighted, poorly ventilated. The general condition of the place as to light and ventilation is poor. Many of the water-closets are small, some dark, and nearly all very dirty.

X. A large number of minors, and a large proportion of the employees in poor condition; 66 children said to be between fourteen and sixteen years of age, but fully one-third appear to be less than fourteen. If they are over fourteen, they are so abnormally small, undeveloped and badly nourished that continued employment in a factory would seem to be most undesirable. In two rooms the exhaust pipes attached to the machinery are absolutely inefficient, and the air is foul with dust.

Y. Large number of children from fourteen to sixteen, and many of them are in poor condition. Rooms occupied by from 40 to 160 persons, are overcrowded and not ventilated. In some the odor of naphtha is strong; in some the dust is excessive. In one, with 40 occupants, a cloud of fine dust flies from eleven scouring machines and settles upon the walls and wherever it can reach, and men complain of great discomfort therefrom. Half of the men look unhealthy. From nine rotary brushes a great deal of fine black dust and lint is thrown, and it settles everywhere, including the faces and especially about the nostrils of the workmen. All of the men in this room, and 3 boys aged about sixteen, appear to be in especially poor health.

Z. Large factory, employing more than 1,000 hands. Room with 360 occupants, crowded with stock and machinery; all windows closed, and air very foul. Room with 130 occupants, 16 of whom are girls, 7 being under eighteen years of age; room is rather crowded; the windows are closed, and the air smells of rubber cement. Room with 260 occupants, who are exposed to considerable dust and strong naphtha fumes; about one-third of the space is occupied by stock and machinery; all of the windows are closed, and in consequence the air is very bad. The light is poor. The men on this floor pay $2 a week from a benefit fund to have the windows opened night and morning outside of working hours. Room with 200 occupants; 30 girls cementing at tables in the middle of the room are exposed to strong odor of naphtha; ventilation much neglected.

Examples of Shoe Factories, neither of very Recent nor of unusually Expensive Construction, with Satisfactory Conditions.

A. A good wooden factory, with well-lighted and fairly well-ventilated rooms. Cutting room on the top floor clean and well lighted; stitching room fairly well ventilated, and not very crowded. On the second floor, the making rooms, in which the processes of edge trimming and bottom filling (with rubber cement) are conducted, are less crowded and better ventilated than usual. The edge-trimming machines are equipped with an efficient exhaust draft. On the first floor the scouring and brushing machines are equipped with an exhaust draft, which carries off the dust very well. In the basement, which is well lighted, is a scouring machine with an effective exhaust draft. The water-closets in this establishment are clean. All machinery well guarded. Employees appear to be in good health.

B. An old brick factory, with unusually clean and well-lighted rooms. The stitching room, situated on the top floor of the building, is clean, well lighted, and with ample cubic space per capita. The edge-trimming machines in the making room are provided with a strong exhaust draft, but with openings too far from the cutters for an excellent result, although the piping is in good order. The scouring and buffing machines are equipped with fans which work very well. All machinery is well protected. The employees look healthy.

C. A good wooden factory, all four stories of which are clean, well lighted, and with ample air space per capita. A dust-collecting system is installed, which is amply sufficient to remove practically all dust from the machines. Both light and ventilation in the stitching and cutting departments are helped by a monitor-top roof with windows which can be opened. The cement used here has no very strong odor of naphtha. The water-closets are well lighted and clean. All machinery is well protected. The employees appear healthy.

MANUFACTURE OF DERBY AND FELT HATS.

In the manufacture of derby and felt hats the essential material is fur, and that used for the best product is from the cony and allied species. This comes to the factory clipped from the skin and treated with cyanide of mercury. The different kinds of fur are mixed together in large covered machines, in which the coarse hair is separated from the soft, downy fur, which latter is taken to the felt machine. This consists of a revolving copper cone, perforated with numerous small holes through which the air is drawn by suction apparatus. The cone is enclosed in a barrel-like covering, open at the top, which has a door in the side for the removal of the felt as made. The fine hairs are blown into the upper part of the enclosure, and they are attracted toward the perforated cone by the air currents going thereto. They are then deposited in a thin layer on the outside of the cone, and when the deposit has gone on to a sufficient extent a cloth wrong out in hot water is applied, and the cone and its covering are removed and plunged into hot water for a short time, the heat and moisture causing the individual hairs to become more intimately matted; then the conical layer is pulled off and sent to the shrinking room.

The newly made felts are rolled into small rolls, and thrown between two rollers which revolve in a trough of hot water. These are deeply grooved in a spiral manner, and are from one and one-half to two inches apart. Because of their spiral construction they alternately squeeze and relax the felt, now squeezing out the water, now permitting the taking up of more. As the water is nearly boiling, the room in which this work is done is naturally hot and damp. The hot water causes the felt to shrink, and in bringing this about the cyanide of mercury with which the fur was originally treated is of assistance.

It is said that some of the men are affected by the mercury compound when they come in contact with it in handling the wet felt. The lesions produced are commonly a few bright red papules, occurring in groups of three or four, or singly, upon the backs of the fingers and hands; these papules itch intensely. Pustules also occur. After a varying length of time, usually short, especially if the lesions are covered with collodion, they disappear, but they may recur. Some men are so susceptible to the effects of the mercury that they are obliged to discontinue their work.

The felts are sometimes shrunk by hand, in which case they are dipped into a trough of boiling water, and the water is wrung out by rolling with a wooden roller. The table at which this work is done slopes away from the workman toward the trough, so that the workman does not necessarily get wet.

The rough felt cone after being shrunk is smoothed off with a machine knife, containing a set of revolving blades which work against a fixed knife, like an ordinary lawn mower. The fluff given off is drawn away by a suction blower pipe, but considerable dust gets into the atmosphere, in spite of all precautions. The cone is then treated with a solution of shellac in wood alcohol, and the excess is wrung out. Then it is placed in a drying oven, and the alcohol is dried out of the felt, condensed and recovered. In some of the establishments visited, the fumes of wood alcohol in this department were markedly strong; and the workmen stated that they are frequently troubled with headaches, vertigo, smarting and burning of the eyes and impairment of vision, and that few can remain at this work longer than three or four months at a time.

There are several other processes, including hardening, sizing, dyeing, pouncing and finishing, which follow; but none of them has any essentially dangerous characteristic excepting that of "pouncing," which consists in smoothing off the rough hairs from the hat rim and other parts, and gives off a great deal of very fine dust.

Of the 4 felt hat factories visited, the largest employs about 350 persons, in a fairly well-lighted and properly ventilated building. The lower story of the building is far wetter than is necessary or desirable; but it must be said that the persons employed there are largely to blame, partly on account of ignorance, and partly on account of indifference. The water-closets are uncleanly, but this also appears to be the fault of the employees. A large dressing-room is provided, but it is built without regard to ventilation, has few windows, and is offensive to the sense of smell. In each of the sizing rooms there is much steam in the air, in spite of six 6-horse-power exhaust fans. In the finishing department the windows are kept closed, but ventilation is secured by means of two large exhaust fans. In the pouncing room there is considerable dust, in spite of the blowers.

The next largest establishment employs 200 persons, in a well-lighted and thoroughly ventilated building. The shrinking room is necessarily hot and damp, but the 10 occupants are very lightly clad, and before leaving the building they make a complete change in their clothing. In the shellac room the fumes of wood alcohol were noted as strong, in spite of eight open windows and roof ventilation.

In the two smaller remaining establishments the conditions were not materially different from those observed in the larger ones with respect to the wood alcohol and "pouncing" dust. Both establishments are well lighted and adequately ventilated. The employees appear to be healthy. In one of them the rooms were not kept in as neat a condition as could be desired.

HORN AND CELLULOID.

In the year 1774, or shortly thereafter, the horn industry had its beginning, in Massachusetts, in the kitchen of the house of Obadiah Hills of Leominster, in which town there are now no fewer than 29 establishments, which give employment to nearly 1,900 persons, in the manufacture of combs and hairpins of horn and celluloid. Three other concerns, 2 in Newburyport and 1 in Northborough, give employment to upwards of 300 more. Until the late 70's the product of the Leominster factories was horn and combs, and then hairpins began to be manufactured as well. The use of celluloid is one of more recent date.

Formerly, every comb maker obtained his supply of horns and "got out" the stock in his factory; but now the stock is bought all pressed, and one establishment in the town makes a business of sawing, spreading and pressing the horns for those who make the combs and pins.

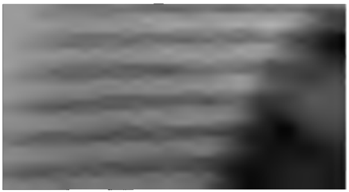
The pressed horn is first soaked in hot water for two or three days, after which it is shaved and split. The next process is known as "polking," which includes "blanking" and "centering." Briefly stated, a flat piece of horn, little larger than is necessary for the production of two pins, is placed under the polking machine, which cuts out the pins and leaves the blank and center pieces. Such a machine is known as a double cutter; a single cutter cuts out but one pin. As the stock is held by the employee while the machine knife comes down and cuts it, there is some danger of losing a portion of the finger tips through inattention or lack of care.

The pins are then taken to the rounding or "edging" machine, which rounds the edges, and in so doing gives rise to considerable horn dust, most of which, in some factories, is removed by blowers. A double-rounder machine is so constructed that it rounds both the outside and inside of the pin; that is, it rounds off all four corners.

Next, the pins are pointed with a pointing machine. The dust from this machine flies about the operator's face more freely than that from the rounding machine; but the best, and indeed most, of the factories connect these machines with exhaust blowers. From the pointing machines the pins are conveyed to the "tumblers," which are square boxes, lined with spruce, and containing fine pumice stone and water. In these they are revolved for a while, and then they are removed, rubbed, and colored with a mixture which contains usually anilin dyes, red lead, lime and bicarbonate of sodium (saleratus). Finally, the pins are polished, bent and packed.

The processes followed in the manufacture of combs are essentially the same as here described.

In the manufacture of celluloid combs and pins the material used consists of sheets of celluloid, about 20 by 50 inches in area, and from .005 to .175 (generally from .125 to .167) inch in thickness. The sheets are cut into small pieces by means of a long-bladed knife, similar to that used in cutting paper, and the work is known as "slashing." The small pieces are taken to the cutting machines, which cut out the teeth of the



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"bench work," and the em-

ubbing" room, which may be a
in one of the workrooms. A
room, about 40 by 8½ feet and 8
outer long side, and a series of
her. Each workman stands facing
, wearing an undershirt, old over-
shoes and a hat. In the stall in
ture of sifted coal ashes and water,
cloth, or cloth and brush, ball. He
wheel, for the purpose of "rubbing
mb may better take the finishing proc-
om 1,200 to 1,400 revolutions a minute,
with a very fine spray of wet ash dust,
in one of these rooms is far from in-
tered with ash mud, the window panes are
oyees are sprinkled with it from head to foot.
ch is a component of celluloid, is brought out
ing, and adds to the general discomfort.
only in more or less damp basements, which
le, from a sanitary point of view, as workrooms.
of the conditions which obtain, it must be said
ployees state of their own accord that they do not
many men have done the work for five, ten, fifteen
longer, and appear to be in healthy condition; that
ell ($2.50 to $3 a day), and that there is always a
are glad to undertake the work. It is said that some
about frequently among the several shops, and are
and much addicted to drink. On the other hand, in
nt rub rooms a majority of the employees have been
m for from five to thirty years.

rubbing balls are made entirely of carpeting, while others
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between The balls are about a foot in diam-
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CONTINUATION OF THE
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The combs are polished on rapidly revolving balls made of new cotton cloth, with the use of rotten stone and lard oil. This process gives rise to more or less lint and mineral dust; but circular pieces of pasteboard or wooden discs are placed over the wheels to keep the dust from the operatives, and none appears to fly directly into their faces. The balls make from 600 to 700 revolutions a minute, and give a high polish to the combs.

The next process is "bending" the combs, which is done by both sexes, but mainly by women and girls. Steam tables or "heaters" are provided for the work. These are covered with asbestos, on which the employees put blocks or "forms" of the kind desired, containing the combs, which are bent and caused to retain the shape which the particular blocks or "moulds" give them. This is bench work of a not disagreeable kind, although the rooms become considerably heated, and the air in winter weather toward night becomes especially dry and foul. In some factories the combs are bent, or shaped, before being polished.

The final process is polishing with a revolving chamois ball, and this is carried out largely by girls and women, who also do the setting of stones and other ornaments.

A quick and cheap process, which originated within recent years, for obviating much of the hand polishing, is that of using the "acid dip," which gives a brilliant luster, making a comb which is much in demand at the present time. The "dip" consists of glacial acetic acid, with perhaps other constituents, the identity of which could not be ascertained. Generally separate rooms are devoted to the use of this dip, and hoods with glass fronts protect the workmen, usually men and boys, from the strongest fumes.

One unaccustomed to the fumes finds them very irritating to the eyes and somewhat irritating to the nose and throat on entering the room. While the use of the "dip" does not appear to be directly injurious to health, the work is confined to a small room, and the employees, by prolonged exposure to the sickening odor, which, if the windows are closed, is strong, may suffer impairment of general health through interference with the normal appetite and digestion.

Avoidance of using the "acid dip" is a good feature in the industry; and it is noticeable that at least two of the best and oldest firms hold entirely, or mainly, to the old method of handwork, which they know produces far better combs. The dip was introduced to save manual labor, and the result is a cheap grade of product and a process which gives rise to possible injurious effects to the employees engaged therein. The employees are generally men and boys, but in some shops they are women. Usually but two or three employees work in one of these rooms.

In the horn and celluloid industry the tendency is to have the work of soaking stock and rubbing or polishing with ashes — work which involves moisture and dust in the atmosphere of the room — done in the basement; whereas these processes should be carried on above ground, in light, large, airy rooms, preferably, perhaps, in the second story.

The "tumbling" room, where pumice stone and water are used to smooth the pins, is usually in the basement. If the basement is light and well planned, it is a good place for this work; but usually the room is dark, and far from being pleasant to work in. It is true that employees do not stay long at a time in these rooms; but a needed improvement is to have them in a well-lighted place, properly ventilated, with cement floor and a catch-basin connected with the sewer, to provide for thorough cleaning of the room.

A large number, if not most, of the "rubbing rooms," in which revolving carpet buff balls and sifted coal ashes are used, are in basements, which, if not damp, are unpleasant to work in, or in quarters which are open to severe criticism from a hygienic point of view.

An improvement to be strongly recommended is to require, so far as is reasonably practicable, as efficient protection to the health and comfort of the operatives as is provided in the best establishments. In one such establishment the rubbing room is a light, pleasant room on the second floor; and, in addition to many large windows, there is a ventilator pipe 15 inches in diameter. The room is large and without partitions, and all conditions, from a sanitary point of view, are very good.

An excellent feature in this shop is the very large rooms without divisions and partitions, with one exception, viz., a suitable room for turning off the rub or "buff" balls, a room well ventilated and lighted. The employees in this room should use respirators when at work.

In the construction of new buildings for the manufacture of celluloid goods, more attention should be given to fire precautions, so that narrow and dark stairways, poorly lighted corners, long, winding corridors, etc., may be avoided. Rooms should be light, well ventilated and plain, without sharp corners and out-of-the-way nooks, so they can be easily swept, and the collection of celluloid dust and shavings be avoided.

Following is a description of a model establishment, situated in the town of Leominster, and employing from 100 to 150 persons: —

New brick building, finely located, on high ground. Best "rubbing room" in Leominster (carpet buff balls and coal ashes); is on second floor, and not in a damp basement, as many are. In addition to many large windows, there is a ventilating pipe 15 inches in diameter. Room 36 by 136 feet; no partitions. Blowers are provided for the "pointing" machines, not for the rounding machines; this considered unnecessary, as the horn dust is moist, and flies about but little. No acid dip is used in this factory. Only high-grade work done here, by polishing on cotton balls.

Basement room is same size as others, is pleasant, and has cement floor.

It has a catch-basin, and the pipe therefrom takes the waste water to sewer. Pumice stone and water on the floor from the tumbling boxes are washed into the catch-basin, which is cleaned out three times in two weeks. The basin prevents the entrance of ashes into the sewer. The room for turning off rubbing and polishing balls is 8 by 16 feet, with cement floor and three large windows. The occupant wears a sponge as a respirator. Fine airy boiler and engine room, 20 by 40 feet, of brick, on first floor, separated from main building; has two doors, one very large, opening outside.

Fire precautions: thermostat system; sprinklers; two lines of hose on each floor of building; twelve fire pails filled with water on each floor; fire extinguishers on first and third floors.

Small wooden storage building, 20 by 50 feet, entirely separate from main establishment. Waste room in same buildings. Toilet rooms in first-class order. No spitting allowed.

Brush Making.

In the manufacture of brushes, hogs' bristles and vegetable fiber are used. The bristles, when not bought already prepared, are in a very unclean condition, and require to be boiled several hours, dried in steam driers and bleached. They are then " dressed " or combed by machinery, and mixed. When unboiled bristles are combed, considerable irritating dust is given off. In the process of setting into handles in the manufacture of varnish, paint and kalsomine brushes, a cement consisting of wood alcohol and shellac is employed; but for shaving brushes a cement of rosin and linseed oil is used, and this is kept fluid by means of electric or non-luminous gas-flame heaters, provided with hoods which communicate with flues.

The 7 brush factories visited in Boston, Lowell and Springfield were found to be adequately lighted and fairly well or excellently ventilated. The machinery was well guarded. The general conditions were found to be beyond criticism, and the health of the employees appeared to be fair or good. The great majority of employees in this industry are women and girls, and in one of the factories several hundred are constantly at work.

Pearl Button Making.

In the manufacture of pearl buttons, machines with cutters resembling surgical trephines cut disks out of shells, with evolution of much fine dust. Much dust arises also in the several processes of drilling, turning and polishing; but it is light, and is effectually carried away by exhaust blowers. Polishing by the wet process is unattended by dust.

Two pearl-button factories visited showed no objectionable conditions whatever. Light, ventilation and general health of employees were reported as good.

THE PAPER INDUSTRY.

The manufacture of paper is one of the leading industries of Massachusetts. In fact, while according to the census of 1900, under the head of "Paper and Wood Pulp," Massachusetts is second only to New York, in the manufacture of paper (apart from wood pulp) this State leads all others. In the course of this investigation 80 paper mills, situated chiefly in the western half of the State, almost one-third of them being in the city of Holyoke, were visited.

The materials from which paper is made include rags, burlap, old paper and wood pulp. Rags are derived chiefly from foreign countries, from which they are imported in bales compressed by hydraulic power. These are opened at the mill, and the contents are put into a closed, box-like structure, known as a "beater" or "thrasher," containing a large wooden roller with iron "fingers," which revolves several hundred times per minute. This separates the rags and shakes them thoroughly, giving rise to much dust, which falls between the long strips of iron grating beneath the roller into a specially constructed receptacle, which may be cleaned out by hand or by means of an exhaust fan and dust pipe. During this process more or less dust commonly escapes into the room, and in some instances the amount is very great, partly because of the very dirty character of the rags handled. From facts gathered with reference to this process in 80 establishments it appears that, with the usual grade of stock, no matter what kind of "duster" or "thrasher" is used, and in spite of exhaust fans and dust pipes, some dust will escape. With high-grade stock certain dusters work very well, while with low-grade stock the results are far from satisfactory. Some very high-grade clean stock gives off little if any dust.

In some mills the dust from the thrashers is collected and baled. This work is exceedingly dusty, and the men who perform it are provided with respirators, which they appear to use with far less reluctance than is shown by those to whom they are supplied in other dusty trades.

From the duster or thrasher the rags are conveyed by hand or through a chute to the sorting room, where they are sorted on tables with box-like tops provided with bottoms of wire netting, through which dust and fine particles escape to receptacles below.

Two persons (men or women) work at each table, one on each side, picking over the rags, cutting off and throwing aside all buttons, whalebones, rubber, buckles, woolen and silk materials, and other objects and substances which should be removed. They may sit or stand, as they prefer, but some of the women assert that they can work better and faster standing. Caps or cloths are worn, to protect the hair from dust.

The air of some sorting rooms is more or less dusty, especially if, as not rarely happens, the dusting machines are situated in an adjoining room with more or less permeable partitions.

The rags go next to the rag "chopper" or cutter, which cuts them into pieces of a certain length, and thence they pass to another which cuts them still smaller. These machines give rise to much dust, the amount varying with the kind of stock used, the type of machine and the means employed to prevent the escape of dust.

From the choppers the material is carried by a conveyor belt to the kettle room, where it is cooked. This room contains a very large revolving boiler, known as a "rag rotary," capable of holding four tons or more of rags. In this boiler the rags, to which is added a certain amount of lime, are kept under steam pressure for a while, and when they are thoroughly "cooked," the boiler, so placed that its doors are nearest the floor, is opened, and the rags fall out; then they are shovelled into box trucks and carried to the "washer."

Instead of a "rag rotary," the open cooking tub is sometimes used. This has a false bottom, which is raised when the cooking has proceeded sufficiently far, lifting the stock and permitting the water to drain back.

In the washing machine the rags are treated with large volumes of clean water, which enters at one end continuously. The stock is guided by a paddle roll around the periphery of the tub to the farther end, where a "washing drum" lifts the dirty water out through a pipe connecting with the sewer.

When the stock is washed sufficiently it is next bleached by means of chlorinated lime ("chloride of lime"), mixed with water in a large tank. Then it goes to the "drainer," which is a large brick vault with a floor of perforated tiles, the perforations being of sufficient size to permit the liquor to drain through and leave the paper stock. When the latter is sufficiently dry it is shovelled out and put into a beater, with perhaps some wood pulp. This machine contains a large roll, bearing knives running on a bed plate, between which and the roll the stock travels while undergoing comminution.

From the beater the stock is emptied into a large tank, known as the "machine chest," where it is thoroughly mixed, diluted and stored, and from which it passes as needed to the paper-making machine.

Old paper is received at a paper mill in the form of bales, which are opened by men and sorted by women and girls. It is conveyed to the "duster" on an endless belt, and in this machine it is freed from dust and torn into pieces by means of revolving wooden rolls, bearing iron pins. The pieces of paper are sorted over like rags, but are not put through the choppers, passing from the dusters to an open cooking tub-

From the box of the paper-making machine the paper stock, diluted with water, is run on to "screens," which consist of series of brass plates with openings one-hundredth of an inch wide. The excess of water is drawn through by suction, leaving the paper stock in the form of a long sheet, which passes through rolls which remove more water, then through "press rolls" and then to drying cylinders, from which it is run to calendars which smooth it, reelers which wind it in rolls, and slitters which cut it to the desired width.

There are various other processes followed in the manufacture of paper, but none of them has any features of special hygienic importance, except exposure to high temperatures and to air saturated with moisture.

From the above description it will have been noted that, from the opening of the bales of rags or paper to the cooking process, the various steps involve exposure to varying quantities of dust, the greatest amount being given off in the earliest operations. It appears that, no matter how constructed, how carefully enclosed, how well provided with blowers and dust flues, a certain amount of dust is inevitable in the rooms where the thrashers and choppers are installed and operated, excepting when unusually clean materials are being handled. If the machines are loosely sheathed or are not adequately equipped with dust-removal devices, the amount given off may be considerable to enormous, according to material. Unless the most dusty rooms are tightly partitioned off from other less dusty ones, — as, for example, a thrashing from a sorting room, — the amount of dust in the air in the latter must necessarily be augmented. In a number of the mills visited the air of the whole rag department was observed to be filled with dust and lint.

The character of the dust brought in with rags varies considerably, as would naturally be surmised from their many different places of origin. Some of the employees state that while at first they suffered from sore throat, cough and loss of sleep, after a time they became so habituated that only an occasional bale causes any discomfort. In some mills it was observed that the dust was far more irritating than that met with in others; especially is this true of those in which burlap is used. Some men assert that the dust from rags of one color may be worse than that from the same kind of cloth differently dyed. Some say that some bales are sickening in their effects, even to old hands.

Of the thrashing rooms visited, a very small number, in which the machines were exceptionally good and where the cleanest grade of rags were being handled, showed no dust; somewhat more, equipped with the same grade of machines and working on the same kind of material, showed but little dust; and the remainder showed considerable to much. About 11 per cent. of the sorting rooms were dustless, about 25 per cent.

were not very dusty and the balance showed considerable to much. Of the cutting rooms, about 7 per cent. showed little or none and the remainder considerable to much. In a number of establishments sorting is conducted in large, airy, well-lighted, mechanically ventilated rooms; but in some of these cutting machines have been installed, and they create considerable dust. Indeed, in the matter of separation of the several processes mills vary; in some the duster and cutter machines are installed in separate rooms, in some they are in the same room.

In a majority of the mills visited a portion of the employees are exposed to an excessive quantity of dirt, dust and lint; and in most of this majority the persons so exposed show not a few who are pale and sickly in appearance.

In 19 mills girls under eighteen years of age were noted as being employed, in no great numbers, in rooms which were very dusty.

In the department where the paper is actually made there is no dust, but the temperature is sometimes excessive, and the air saturated with moisture. The latter condition is not only promotive of discomfort, but exposes the paper to damage through condensation and dropping, wherefore, exhaust ventilation is commonly resorted to.

The paper industry, being one which exposes its followers to every kind of dust and dirt which can be carried in rags, is naturally looked upon by many as a dangerous trade. It is unfortunate that it is impossible from statistics available to determine in what relation this industry stands to others of the dusty occupations. The death certificates of the city of Holyoke, the center of the business in this State, were examined; but they proved to be too indefinite for use, since the terms "paper worker" and "mill hand" are commonly applied to all employees, whether engaged in the dusty or non-dusty processes. Comparing, however, the death rates from tuberculosis, pneumonia and bronchitis during the years 1901, 1902, 1903 and 1904 with those of the State at large, it was found that the Holyoke rates were under rather than over the average.

EMERY AND CORUNDUM.

Corundum is an extremely hard oxide of aluminum, used for polishing; emery is a very hard, granular variety of corundum, containing a small amount of magnetite or hematite. Ground to powder, these substances are used for polishing, grinding or abrading stone, metal, glass, etc. In the crushing and grinding process, which is conducted in machines more or less completely enclosed, considerable very fine dust is given off, in spite of efforts based largely, it must be said, upon considerations of economy. The dust is peculiarly irritating, causing burning and smarting in the nose and throat in the case of those not habituated to its inhalation. After sifting and grading according to fineness, the product is stored in appropriate compartments, from which it is taken as needed, with evolution of dust.

Wheels and stones of various shapes and sizes are made from the ground material mixed with one or more cohesive substances, which include clay, glue, shellac and certain others. The operation of mixing is attended by much dust. The mixture with clay, after suitable moistening and molding, is fired in kilns, and the resulting stones and wheels are much harder than those made with glue, shellac, etc., but the latter are more elastic and less likely to break. The wheels in the rough state are set up and revolved rapidly and cut down to proper size and smoothness with a steel tool, and in this operation great clouds of dust are given off in all directions. Some of this work is done by the wet method, which reduces dust production to a minimum. The completed wheels are finally tested in a metallic compartment, where they are run at an exceedingly high rate of speed; and those which pass the test without breaking are considered safe, since they are never again subjected to the same strain in any work in which they may be used.

This line of industry, being one of the dustiest, and the dust being of a particularly irritating kind, may justly be classed among the trades which are intrinsically dangerous to health; but, as is the case with other dusty occupations, few of those employed can be induced to wear respirators. In the largest of the 5 establishments visited, employing more than 300 men, only an occasional workman was observed wearing this means of protection. In 4 of the 5 the ventilation, apart from the dust, was noted as fair, and in the largest of them ventilating fans are in use in the dustiest parts of the factory. In all the light was noted as good or fair, with the exception of the one which was noted as poorly ventilated. This one, however, is a very small establishment, in which 2 men do all the work, and buys its emery ready crushed.

In the largest factory lunch rooms and lounging rooms are provided for the employees.

While the great majority of the employees in the several establishments appear to be well and strong, a notable proportion present a pale and sickly appearance. The habit of promiscuous spitting is indulged in to a very considerable extent.

Sandpaper Making.

Sandpaper is made by spreading sand or "garnet" on paper smeared with glue, and drying the product over steampipes. "Garnet" is a fine gravel obtained in the Adirondacks. It is ground, sifted and graded by machinery provided with hoods and exhaust pipes; but in the only factory of this kind visited there was, in spite of the working of a 48-inch exhaust fan, to which the pipes are connected, a great deal of fine dust in the air. Those exposed to this dust are urged to wear respirators, but they prefer not to do so; and, in spite of their refusal, all of the 80 or 90 employees appear to be in good health. The lighting and ventilation of this establishment may be rated as only fair.

STONE CUTTING.

The stone-cutting industry is justly classed as one of the dangerous trades. It requires of its followers great strength, for the hammers are heavy and the blows are struck with considerable force, and good workers work fast. In the processes which do not involve the use of hammers, but of machine tools, the work is very laborious, and is not suited to those of poor physique.

It is preëminently a dusty trade, and the workmen are, therefore, exposed to the danger of inhaling nonabsorbable and irritating particles of mineral matter. Accidents to the eyes from flying chips are also very common, but they are generally less serious than those due to fragments of steel from the tools employed.

Of the various kinds of stone dust, granite is regarded as more injurious than marble, and soapstone the least of all; but different granites vary in this particular, some yielding a much finer dust than others, on account of differences in texture.

The greatest amount of dust comes from the surfacing machines, which are operated with compressed air. The tool is either a large hammer or an instrument which presents four smaller separate faces. Sometimes a bushing hammer, made of thin, chisel-like blades bolted together, is used; this creates the finest dust of all.

The men who operate the surfacing tools rarely wear masks, but many chew tobacco and spit, in the belief that the practice serves to protect them from the effects of the dust to which they are exposed. Some protect themselves from flying chips by means of wire screens placed about the hammer; some wear wire masks and some wear glasses. By a union regulation, surfacing is done in the open sheds in the yard.

While the operation of smoothing cannot be done by the wet process, on account of clogging of the tools with the pasty material which would thereby be produced, polishing is conducted with the application of water, which prevents the evolution of dust. The sawing of granite and marble into slabs is conducted ordinarily by the wet process, and is therefore unattended by dust; but soapstone sawing and cutting for joints is frequently done dry, and with the evolution of much fine dust. Turning in lathes is conducted in the wet way, and is dustless.

In general, the granite-cutting business is conducted in large, open sheds, some of which have roofs which can be lifted; but even there and in the open yards the workmen are exposed to clouds of dust, especially those who operate the pneumatic tools. Work on marble and soapstone is, however, conducted in doors in the few establishments found.

"Stone cutters' consumption" is very common, especially between the ages of forty and fifty; and it is a well-established belief among those employed that it is the careless and those who indulge in alcoholic beverages who, as a class, are most likely to become infected.

Of 343 deaths which occurred in the city of Quincy among stone cutters during a period of about sixteen years, no fewer than 142 (41.4 per cent.) were due to pulmonary tuberculosis, 41 (12 per cent.) to other diseases of the lungs, 44 (12.8 per cent.) to diseases of the heart, 24 (7 per cent.) to violence and 92 (26.8 per cent.) to all other causes. Excluding accidents, the percentage due to tuberculosis was 44.5. These statistics show even more strikingly than those quoted in the report submitted two years ago the dangerous character of this occupation. Therein it appears that, of a total of 30,000 deaths among stone cutters, tuberculosis was the cause in 28.57 per cent. It must be said, however, that the average age at death of the victims of the disease in this industry, so far at least as the Quincy records show, is somewhat high (47.8 years), but it is to be borne in mind that the calling is one which is not open to the naturally weak, and that many of those who become incapacitated through infection drift into other lines of industry in which physical strength is not so essential, and hence at death are not returned as belonging to this class.

In the course of this inquiry there were visited 85 establishments devoted to this industry, and employing about 2,600 men: 5 in Boston, 4 in Milton, 5 in Milford, 68 in Quincy and 3 in Rockport. As stated, most of the work is done in the open air, or in sheds with open sides and movable roofs; but under the best of conditions, where the operations are conducted necessarily without the use of water, there exists the danger of dust inhalation, which apparently cannot be reduced by means of appliances commonly used in in-door, dusty occupations. Unless the workmen can be induced to protect themselves against dust inhalation by the use of respirators, which aids to maintenance of health are declined commonly by reason of the discomfort which their employment entails, there appears to be little hope of removing this industry from the list of dangerous trades.

In a large number of the yards and sheds visited a considerable proportion of the employees showed various evidences of impending or existing ill health.

GLASS CUTTING AND POLISHING.

Operations which cause glass dust in the air are recognized as especially dangerous to health, such dust being quite as irritating as steel dust, if not more so. This being the case, glass cutting and polishing are conducted with a minimum of danger in the wet way.

In cutting, the pattern is marked out with red lead or with graphite, and then the object is held against a rapidly revolving steel wheel upon which fine quartz sand and water are dropped continuously, or upon a wheel of fine emery and corundum. When the pattern has been cut out, the glass is plunged into hydrofluoric acid in lead tanks, connected with the exhaust pipe of a steam-propelled blower. This smooths the cut surfaces, but acts on the uncut parts to such an extent as to make polishing necessary. This is done with pumice or rotten stone and water or oil on revolving brushes, and putty powder or rouge and wax on wooden wheels. The use of oil or water serves to prevent dust, and the employment of wooden shields protects the worker from being spattered with the mixture of water or oil and glass powder and other materials thrown off in the process.

For successful work good light is very necessary, and in this respect all 5 of the establishments visited were found to be beyond criticism. The conditions as to ventilation and toilet arrangements were found to be equally commendable.

All cutting and polishing is done by the wet method, and in no instance was any dust perceptible.

In 2 of the establishments in which glass blowing also is carried on the employees are necessarily exposed to high temperatures and to the possible danger which resides in the use of blowpipes, which are introduced indiscriminately into the blowers' mouths. Otherwise, no objectionable features were noted.

The number of persons employed in the several factories ranged from about 30 to several hundred. As a class, they appear to be of a rather high order of intelligence and to enjoy good health.

MANUFACTURE OF OPTICAL LENSES.

In the larger of the 2 establishments visited where optical goods are manufactured, about 600 persons are employed; in the smaller the number of employees is below 50. In both places lenses are ground by machines with the aid of rouge (iron peroxide), but, as the grinding is done by the wet process, no dust is created. The use of rouge on cloth polishing wheels, however, gives rise to a certain amount of dust, which covers the hands, clothes, and to a considerable extent the faces of the polishers, in spite of hoods and exhaust fans. In the larger a laundry is maintained for supplying the operatives with clean overalls.

In both establishments the light and ventilation are good and the sanitary arrangements are satisfactory, and in both the operatives appear to be in good health.

MANUFACTURE OF MACHINERY, MACHINE PARTS AND METAL SUPPLIES.

In the manufacture of machinery and metal supplies there are several operations which involve exposure to dust fumes, vapors or extreme heat. These include making castings, cleaning and smoothing, grinding and polishing, and scaling.

Casting. — In casting iron and brass the workmen are exposed to extreme heat; and in the case of brass to heavy fumes, which are evolved as soon as the molten metal begins to be poured into the moulds.

Cleaning and smoothing Castings. — Castings are cleaned and smoothed in various ways: by means of emery wheels and revolving wire brushes, by being rotated in "tumblers" or "rattlers," by chipping with pneumatic chisels and by means of a sand blast.

The use of emery wheels and revolving wire brushes gives rise to much dust, and, if the wheels are not equipped with hoods and fans, the air becomes thick with it. Some operatives wear glasses to protect their eyes from the escaping dust.

In the use of the sand blast the operative wears a canvas hood and mask resembling a diver's helmet, and is supplied with air through a small pipe which enters at the top. Rooms where this work is done are filled with flying sand and dust, the greater part of which, in some establishments, falls between the iron pipes, of which the floor is constructed, to the rooms below.

When castings are smoothed by being rotated in "tumblers" or "rattlers," unless these are tightly built or equipped with hoods and blowers, much dust and dirt are given off.

Scaling. — In the removal of scales castings are wet with dilute sulphuric acid. The fumes arising in this process and while the castings are draining are very distinctly irritating to the nose and throat. Small castings may be dipped into a tank set into the floor, but larger ones are wet by having the acid thrown over them on the floor, which latter is so constructed as to permit the excess of acid to drain back into the tank.

Grinding and Polishing. — In these processes the amount of dust which arises varies according to the kind of work and provisions made for dust removal. Light polishing on emery wheels equipped with good hoods and adequate exhaust ventilation gives rise to but little dust; while heavy grinding on large emery wheels may create a great deal, in spite of the best of hoods and most powerful of blowers. Automatic grinding machines, completely enclosed and well equipped with hoods and blowers, expose the workmen to little or no dust.

Enormous amounts of fine steel and emery dust are given off in the grinding of "tops and flats" (surfaces, either curved or flat, covered with stiff steel wires like a brush), unless the emery cylinders used are adequately equipped with exhaust ventilating appliances.

While the nature of some of the processes is such as to warrant classification of this industry with the dangerous trades, the conditions under which the work is done are very largely responsible for the injurious effects on the health of the employees, and these conditions are to a considerable extent avoidable or at least susceptible of improvement.

Factories visited.

The 24 establishments included under this heading are divided as to the character of their products as follows: —

Cotton machinery (Hopedale, Lowell, Whitinsville, Taunton and Fall River),	6
Tanners' machinery (Peabody),	2
Paper machinery (Fitchburg and Worcester),	3
Shoe machinery (Beverly),	1
Drilling machinery (New Bedford),	1
Confectioners' machinery (Springfield),	1
Sewing machines (Orange),	1
Rivets, screws, bolts, nails, tacks (Quincy and Worcester),	3
Valves and hydrants (Boston and Holyoke),	2
Miscellaneous (Boston, Canton, Taunton and Worcester),	4

The number of persons employed in these factories ranges between 12,500 and 15,000, and of this number more than half are engaged in making cotton machinery.

Light and Ventilation. — In these 24 establishments the light varied in the different departments from good to moderately or distinctly bad, but in none was it found to be generally poor or bad.

With two exceptions, the ventilation of rooms other than those in which processes are conducted which give off dust or fumes was found to be at least fair. In one there was no provision for fresh air, and the air was distinctly foul; in the other the air introduced was the heated, already foul air of another department.

In the departments in which ventilation and good light are most necessary, namely, those in which dust and fumes are given off, one or the other was found commonly to be lacking. Adequate ventilation and suitable devices to promote the removal of vapors, fumes and dust would go far in removing this industry from the category of occupations dangerous to health.

Following are some of the objectionable conditions observed in the cotton machinery establishments: —

Casting Brass. — In one instance the only escape for the gases and fumes is by way of the doors and windows, there being no roof ventilation.

Tumbling Castings. — In one place some of the tumblers are provided with blowers and good exhaust draft, and create practically no dust; while others not so equipped give rise to considerable dust, to which 70 men in a badly lighted basement are exposed. The conditions here are in marked contrast to those obtaining in another establishment, where the tumblers are of very tight construction, adequately ventilated by fans, and productive of no dust whatever.

Grinding and Polishing. — In one room 28 emery wheels and grindstones are in use, the latter provided with heavy iron hoods which cover them almost completely; but the emery wheels, being quite unprotected, cause the air to be exceedingly dusty. In another, occupied by 70 workmen, there are 25 emery wheels which formerly were equipped with hoods and large-sized exhaust pipes, most of which have now, however, been removed. The air of the room is exceedingly dusty, and about one-tenth of the occupants look pale and sickly.

Grinding "Tops" and "Flats." — In one place the emery cylinders are not provided with hoods; the amount of steel and emery dust in the air is very great. All of the men look pale and sickly, and all complain of the irritation of the air passages by the dust.

Dipping Castings. — In one place this work is carried on in a badly lighted basement room, and all of the 7 occupants appear to be in bad physical condition.

Cleaning and smoothing Castings. — In a poorly lighted room, in which 12 emery wheels are without any sort of dust-removing apparatus whatever, 25 men are engaged in the dirty, dusty work of "snagging" or "chipping."

The 2 tanning machinery factories showed but few objectionable conditions. Both are fairly well lighted and ventilated, and the employees look healthy. The brass foundry of one is low studded, and lacks suitable means for the escape of smoke and fumes; but the tumblers are of very tight construction, and are situated out of doors.

In one a few emery wheels are unprovided with hoods and blowers.

The 3 paper machinery factories visited are well lighted, and in general at least fairly well ventilated. The employees look healthy. In one factory the type of tumbler used is such as to merit especial mention, because of its generous proportions and effective dust-removal apparatus. The machine shop departments are above the average in all respects, but the brass foundry is not ventilated. The brass foundry of one of the others is reasonably well ventilated, but the fumes which come off in clouds during casting are very troublesome and do not pass readily away.

In the other factories of this class the conditions observed were mainly commendable. Those which were found to be objectionable include the following: —

Brass Casting.

A. A very large amount of coal gas gains access to the casting room, owing to defective draft. This is very troublesome to the men working near the furnaces.

B. The air of the brass foundry is heavy with fumes, especially in winter, no mechanical ventilation being installed. The 8 men at work assert that they have occasional attacks of poisoning ("brass founders' ague"), which they treat by remaining at home and "sweating it out of the system."

Cleaning Castings.

A. Tumbling castings in a poorly lighted, unventilated room, the air of which is filled with dust and plumbago from the castings. The 8 men present are black with this dirt.

B. Room, with 6 occupants, so thickly filled with dust and dirt that even the four or five gaslights (the sole means of lighting) cannot be distinguished across the room, and a man cannot be made out at a distance of four feet. The dust and dirt come from ten loosely constructed tumblers. Means of ventilation: a few small openings in the roof, two small windows and a door. In the same establishment, a room with 40 occupants is very badly lighted, and, in spite of blowers and dust flues, is filled with emery and other dust. Also, an attic room, occupied by 9 men, is badly lighted, foul and exceedingly dusty, in spite of hoods and blowers. Chipping and snagging is done in an exceedingly dusty, badly lighted room, in which there are 12 emery wheels without hoods or blowers.

Dipping Castings.

In one establishment the castings are dipped in a small, badly lighted, unventilated room, the air of which is exceedingly disagreeable from concentration of the fumes.

A Model Establishment.

Following is a partial description of a model establishment in which are employed many hundreds of men: The comfort of the employees is carefully looked after. The rooms are light, and not crowded. Lunch rooms are provided, and food can be purchased at reasonable prices, or it can be brought in, as desired. A series of bath rooms is provided for men, and another for women. The toilet rooms are large, clean, light and properly ventilated. The iron foundry is very high; it is light, and amply ventilated through the roof. The tumblers and emery wheels are provided with hoods and blowers which are effective, and there is practically no dust. The rooms in which castings are dipped are properly ventilated, and all fumes are effectively removed. All of the machinery is well protected.

IRON AND STEEL FOUNDRIES.

Of 14 iron and steel foundries in which castings of all sorts are made, situated in Boston, Chelsea, Dighton, Fitchburg, Greenfield, Lawrence, New Bedford, Orange, Springfield and Worcester, 7 showed generally poor conditions as to light, ventilation and dust removal. One showed commendable conditions throughout. This establishment employs 250 persons, in well-lighted, adequately ventilated and practically dust-free rooms, and is engaged in the manufacture of elevators. Another, in which 150 men are employed, in a well-lighted, and, apart from dust, adequately ventilated building, has a department in which the castings are sand-blasted, which is so heavily impregnated with flying sand that it is impossible to see across the room even in bright sunlight. The sand gets into the mouth, nose and eyes, and the employees suffer considerably from soreness of the last-mentioned organs. In another, in which about 1,500 employees are engaged in the manufacture of pumps, each sand-blast room has small windows at the top, openings in the roof, and a large flaring hood in the center, with upward-suction draft. The castings are placed under the hood and the sand-blast is played on them, the operatives wearing helmets with fine wire inserts to protect the eyes, and cloths underneath the helmets to protect the nose and mouth.

STOVE FOUNDRIES.

Of the 9 stove foundries visited, in Chelsea, Fitchburg, Gardner, Hyde Park, Taunton, Watertown and Westfield, 4 presented moderately bad and 1 distinctly bad conditions, while 1 was found to be conducted under conditions which may be regarded as sanitarily ideal. This establishment employs about 1,200 men, in well-lighted and adequately ventilated buildings. The room in which castings are cleaned and tumbled is large, light and airy, and has a tight cement floor. In the polishing room the emery wheels are well equipped with hoods and exhaust ventilation; but the men, unmindful of the protection provided, habitually remove the hoods, and become covered with emery and iron particles. The brass-casting room is very high studded, and is ventilated so well that the fumes and vapors are rapidly removed. The iron-casting department, occupied by 300 men, is very large and of good height, and is very efficiently ventilated. A large wash room, with cement floor, lockers, hot and cold running water and numerous shower baths, contributes greatly to the promotion of personal hygiene and comfort of the employees.

Among the other establishments of this class, 4 are poorly lighted in most departments, the tumbler rooms and polishing departments are exceedingly dusty, and most of the emery wheels are unprovided with hoods and mechanical exhaust ventilation. Another employs 275 men, in low-studded, poorly lighted, unventilated buildings, in which there is no attempt to remove the dust arising from the processes of polishing and buffing by hoods and exhaust ventilation. In the tumbling room the dust is so thick that objects a few feet distant cannot clearly be made out. Many men refuse to work in this establishment in the hot months, on account of the excessive heat and general discomfort.

Brass and Iron Foundries.

Six establishments of this class, situated in Fall River, Fitchburg, Gardner, Newburyport, Pittsfield and Woburn, were visited, and in 3 of them the work of cleaning castings by scratching and tumbling was found to be done in small, poorly lighted and ill-ventilated rooms. In 2 the brass-casting departments were found to be unprovided with roof ventilation, and the rooms were heavy with fumes; but in 2 others the light and ventilation were most commendable, and in 1 of these there is good roof ventilation, and the furnaces in which the composition is melted have special flues and exhaust fans for the removal of smoke and fumes.

Brass Foundries.

With few exceptions, the conditions as to light, ventilation and protection from dust observed in the 35 brass foundries visited, in Boston, Fitchburg, Williamsburg, Holyoke, Lawrence, Lowell, New Bedford, Orange, Peabody, Salem, Springfield, Westborough, Westfield and Worcester, were very satisfactory. In one establishment 5 men were found to be exposed to very irritating fumes, which escaped slowly by the windows; in another 30 men were similarly exposed in a room of fair size, but with no means of ventilation; in several others a smaller number of men were at work in rooms with no outlets for fumes.

The Cutlery and Tool Industry.

From a sanitary point of view, the one important part of this industry is the reduction of the surface of the article in process of manufacture from the roughness of the original casting to the smoothness and brilliancy so necessary and desirable in the finished product. This involves successive treatment by wet grinding, dry grinding on emery and corundum wheels, and polishing with rouge on buffing wheels. Each of these processes, even that of wet grinding on large, coarse and finer stones, causes to be cast into the air large amounts of fine dust, made up of very fine particles of steel and of the abrasive substance. In establishments properly equipped and conducted, provision is made to reduce the danger of this dust to a minimum by means of hoods connected with a system of exhaust fans or blowers. In spite of the precautions taken to protect their health, a very large proportion of grinders recklessly remove the hoods, and thus expose themselves unnecessarily to this especially dangerous form of dust. They assert that they prefer freedom of movement, with dust, to the protection afforded by hoods.

Concerning the dangerous nature of this calling there is no dispute. It is notoriously one of the most dangerous of trades, the prevailing disease among its followers being tuberculosis, which among this class is known as "grinders' asthma" and "grinders' rot." The employees readily admit that grinding and polishing are dangerous, but they do not agree as to which of the two is the more dangerous.

The workmen are not, as a class, long-lived; indeed, the nature of the work is not compatible with longevity, and a person entering upon it in middle life is unlikely to follow it many years. Whatever the age at which the trade is taken up, a man in sound health who has followed it a few years is an acknowledged rarity. A study of the death returns of the city of Northampton, which is one of the centers of this industry, for the past twelve years, yields facts which can be interpreted in only one way. During this period tuberculosis is given as the cause of death in no less than 54.5 per cent. of those whose occupation is indicated by "grinder" or "polisher," and in 45.4 per cent. of those designated generally as "cutlers;" and, of the latter, 36.4 per cent. died of pneumonia. Taken together, the "grinders," "polishers" and "cutlers" returns show that, during this period, diseases of the lungs were responsible for 72.73 per cent. of their mortality. As was shown in the preliminary report on this industry, the tuberculosis death rate for cutlers in Northampton is four times as high as that for the entire adult male population.

Twenty-eight cutlery and tool-making establishments were visited. These are widely scattered, but the majority are situated in the western half of the State. The places visited vary in size, from those employing less than a half-dozen to one employing about 250.

In general, the light was noted as fair or good; but the ventilation was observed in many rooms to be very defective, while in others it was noted as adequate.

Of 3 establishments engaged in the manufacture of machine knives, 2 were found to be well lighted and properly ventilated, and the wheels equipped with efficient hoods and blowers. In a basement room of the other were found 4 large emery wheels not provided with blowers, and the air was very dusty.

Of 2 engaged in making saws and machine and belt knives, 1 has effective blower ventilating apparatus, and is only slightly dusty; the other is not so equipped, and the men are much exposed to dust.

Eight small shops devoted to saw filing and cutlery grinding presented no objectionable features.

Two razor factories showed objectionable conditions. In one is a room containing between 20 and 30 emery wheels without blowers, and the air was full of emery and steel dust. The other occupies a large, new building, which is well lighted excepting in the basement, where 40 girls are employed; and adequately ventilated excepting in two buffing and polishing rooms, in which 19 men and 4 boys are exposed to considerable dust.

Of the remaining cutlery establishments of various sizes, 5 are properly lighted and adequately ventilated, and present no objectionable features. In 4, which employ respectively 62, 66, 37 and 250, hoods are provided; but the employees remove them, in order to see better and to have more freedom of movement, and the grinding and polishing departments are consequently very dusty. In the largest of these the hoods are removed in spite of orders to the contrary, and the 36 occupants evince no interest in this danger to their health. In other departments of this same factory there is much dust, in spite of efforts on the part of the proprietors to reduce its amount.

Four establishments, one small and unusually clean and well kept, one employing 89 men, another employing 27 and the fourth employing 11, have no hoods over the emery wheels, and this is their only objectionable feature. They are naturally dusty.

In all of the factories of this class the machinery was found to be effectively guarded, and the water-closets to be in at least fairly clean condition.

Of this industry it may fairly be said that, even where employers show a commendable inclination to safeguard the health of their workmen, a large proportion of the latter show a reckless disregard of their own interests.

MANUFACTURE OF AGRICULTURAL TOOLS AND IMPLEMENTS.

In the tool and agricultural implement industry the processes followed in making the metallic parts are essentially the same as in the manufacture of machinery and machine parts; but in addition to these are several which enter into the making of handles of hard wood. A wood called "coca-bola" is considerably used, and its dust is peculiarly pungent and irritating, causing coryza and not infrequently troublesome dermatitis. Some persons suffer from coryza for a week or two, and then become accustomed to the dust; but others never acquire such immunity, and are obliged to discontinue work in this department. Wood alcohol varnishes are commonly used on the handles, and give off their characteristic fumes.

Twelve factories, situated in Athol, Boston, Fitchburg, Greenfield, Holyoke, Easton, Montague and Worcester, and employing approximately 1,000 men, were found to be generally well lighted, and, apart from dust, fairly well or adequately ventilated. In each factory the employees, with few exceptions, and these in the departments where the dust is most abundant, appeared strong and healthy. Not one factory presented even moderately bad general conditions, and in 3 the conditions were found to be sanitarily ideal, the rooms being well lighted and thoroughly ventilated, the polishing and buffing wheels provided with efficient hoods and blowers, and the acid dipping rooms with hoods and good exhaust ventilation.

MANUFACTURE OF FIREARMS, BICYCLES, ETC.

Seven establishments, devoted to the manufacture of firearms, bicycles and skates, were visited, in Chicopee, Fitchburg, Springfield and Worcester. In the majority of these the light and ventilation were found to be good, but in certain departments, where the polishing of metal and wooden parts is carried on, the amount of dust in the air was found to be excessive. In one of the factories the only objectionable conditions observed are the exposure of 16 men, working in a room 40 by 45 feet, to large amounts of very fine black walnut dust; and the exposure of 12 men in the steel-bluing room, 40 by 30 feet, to the fumes of burning charcoal. In another not only was there considerable wood dust, but three of the emery wheels were unprovided with blowers and exhaust fans, so that there was emery and steel dust in addition.

In one establishment, in which the light and ventilation are poor and in which the grinding and polishing rooms are so dark as to require the use of illuminating gas all day, the dust was observed to be adequately removed by means of mechanical ventilation; but in the buffing rooms there was much rouge and other dust in the air, in spite of the hoods and blowers.

In another establishment the hoods and exhaust fans were found to be not wholly efficient in removing black walnut dust, nor in preventing the escape into the air of emery and steel dust.

In one establishment, of considerable size, every condition observed was found to be worthy of commendation. The light and ventilation are good. The buffing wheels are well equipped with hoods and blowers, and they give off practically no dust or lint. There are the best of modern washing facilities, toilet arrangements and clothes lockers.

Galvanizing Iron.

In galvanizing, the iron is first "pickled" in a vat of weak acid (hydrochloric and sulphuric), which removes scales and prevents oxidation during the next process, — that of immersion of the pickled iron in a tank of molten zinc. As soon as the two metals come in contact, acid fumes are given off, and frequently cause considerable discomfort, which is greatly augmented by the dense fumes which arise from throwing sal ammoniac into the zinc before and during the withdrawal of the iron. These fumes are so irritating to some, especially those with bronchial troubles, that they are obliged to discontinue the work.

Of 3 galvanizing establishments visited in Boston, 1 was found to be poorly ventilated and badly lighted, but the other 2 presented no objectionable conditions, the ventilation being so effective that the fumes are drawn off through air shafts with great rapidity. The workmen in all 3, about 60 in all, appeared to enjoy good health, and asserted that, beyond sneezing and coughing at times, they suffer no inconvenience or discomfort.

Wire and Wire Cloth Making.

In the open-hearth steel department of a wire-drawing establishment the men are exposed to extreme heat, and heat exhaustion is said to be the commonest accident in summer. The work of pouring the molten steel is necessarily in charge of men of a high order of intelligence, capable of determining when a furnace is "ready to pour." The steel ingots when ready are rolled into long bars of much smaller width and thickness, and the workmen are protected as much as possible from the heat by metallic screens over which water is kept trickling.

In the operation of wire drawing considerable lime dust gets into the air, lime being put on the wire to prevent it from rusting. This department is interesting mainly from the point of view of accidents, the most frequent of which are the result of getting the fingers caught between the wire and drum in drawing from the block; but other more serious accidents, such as fracture of the bones of the leg, punctured wounds of the breast and other parts, sometimes occur. These are caused in some cases through inexperience in the work, and in some by carelessness; but in the majority of cases they are not due to lack of ordinary care on the part of the injured, nor to negligence on the part of any other person.

After the wire is hardened by being run into crude oil it is passed through kettles of molten lead inside the tempering furnaces, and is then finished and wound for shipment. From the tempering furnaces dense blue fumes arise, and envelop the men whose work it is to feed and tend them. Occasional cases of lead poisoning occur in this department. In one establishment, one employee of five years' experience shows the characteristic blue line of lead poisoning on the gums; and another, of fourteen years' experience, in the same room, has a history of "wrist-drop" and other evidence of chronic poisoning. Efficient mechanical ventilation is most necessary in this work, but it is not always provided.

In annealing and pickling, hot, very weak sulphuric acid contained in large vats is used. These vats are sometimes covered with hoods, sometimes not.

Sulphate of copper is used for coppering the wire, and is employed in different strengths. One man, who has followed the work of this department in one establishment for twenty years, asserts that he is in good health, but his appearance testifies otherwise; and a greenish line is observable in the gums, where the blue line is seen in cases of chronic lead poisoning.

In the operation of galvanizing, the wire is passed first through commercial sulphuric acid, then into a weak solution of "spent" hydrochloric acid, and finally through molten zinc. The fumes from the hydrochloric acid are abundant and strong.

In making wire cloth and netting and fencing, wire is first rolled on spools and drums to form the warp, and then the weaving is done on heavy looms.

Japanning is done in a suitable tower, the cloth passing from the rolls through a trough of japan, and as it emerges being subjected to the action of a blower; then passing upward through several stories, where it is dried by steam heat, and finally descending on another side to be wound again into rolls.

In one establishment, where 2,500 men are employed, the lavatories are very small and inadequate. In one sink room there is neither hot water nor soap, and the water-closets are dark and dirty in the extreme. In pleasing contrast are the wash rooms and water-closets of a smaller corporation, which employs about 200 men. All are well ventilated, clean and light. The closets are of the best modern construction, and the sinks are provided with running water, both hot and cold.

MANUFACTURE OF INSULATED WIRE.

In the manufacture of insulated wire, the wire covered with rubber is placed in metallic containers with powdered chalk, which is used to prevent the coils from adhering to each other. The containers are made to revolve by hand power on ball-bearing tables, and as they revolve the wire is unwound and removed, and at the same time the chalk dust is scattered in all directions. The coils of wire are then put into a vulcanizer and exposed to steam heat at 270° F. for five hours or longer, at the expiration of which time they are removed.

The manufacture of insulated cable is conducted by practically the same process. In the one establishment of this sort visited, wherein are employed 250 to 275 persons, the light, ventilation and sanitary appliances are of the best, and the machinery is properly protected.

MANUFACTURE OF ELECTRICAL APPARATUS.

Under this heading are included electrical switchboards, meters, telephones, registering devices, etc.

The largest of the establishments visited gives employment to 3,000 or more persons, who operate in two sets of very large brick buildings, in which a very large number of processes are carried on. In the great majority of these processes there are no necessarily insanitary conditions.

In the department where castings are cleaned by means of the sand blast, a number of the employees, who wear glasses, masks and canvas shields or aprons to protect themselves from the flying sand, look pale and suffer somewhat from inflammation of the eyelids, due to the very fine particles of sand which fill the air. The tumblers are equipped with blowers, which appear to be very effective in carrying away the dust. In two of the emery polishing rooms, respectively 40 by 25 feet and 150 by 50 feet, although the emery wheels are connected with blowers and hoods, the air is filled with emery dust. Both rooms are also very poorly lighted. In one of the buffing rooms, although most of the dust is carried away through exhaust pipes, some rouge is perceptible in the air. In one room, in which castings are cleaned by means of acids, there are hoods over the tanks, with mechanical ventilation, by means of which the fumes are very adequately removed.

The brass foundry, in which about 65 tons of brass are cast monthly, is exceedingly well ventilated, and is a model building for the purpose.

In the japanning rooms, where metal parts are dipped into or painted with japan, and allowed to drain off before being baked, there is a strong, disagreeable and somewhat irritating smell, due to the japanning solution; and in another room, in which 6 children between the ages of fourteen and eighteen are engaged in dipping metal parts into lacquer, there is a strong odor as of wood alcohol.

Concerning other features of this establishment little need be said, the conditions throughout being at least fairly commendable.

The establishment second in size gives employment to about 1,000 men and 75 women, in light and thoroughly ventilated buildings, in which all of the conditions may be rated as good. This establishment provides a large, attractive lunch room, which is used by a very large proportion of the employees.

The foundry is very large and open, and is from 50 to 75 feet in height.

The emery polishing rooms are so well equipped with hoods and fans that only a very slight amount of dust is perceptible.

In the japanning department the work is done with the exercise of so much care that little discomfort is occasioned.

The establishment third in extent occupies a number of buildings, in which the light varies from good to poor, and the ventilation is assisted by hoods and exhaust fans. Most of the conditions observed are commendable, and only a small proportion of the 400 employees, and these chiefly young girls and women, appear to be in poor physical condition.

The remaining smaller establishments are well lighted and ventilated; the emery wheels have efficient hoods and blowers, the general conditions are commendable and the employees look healthy.

Manufacture of Surveyors' Instruments.

In the 2 establishments devoted to the manufacture of surveyors' instruments, in which together somewhat more than 100 persons are employed, the general conditions as to light, ventilation and sanitation were noted as good. In both the acid dipping of brass parts is conducted under good-sized hoods, which are efficient in carrying off the fumes. In both establishments the lacquering is done by women, but the lacquer is made with grain alcohol instead of wood alcohol. There is practically no grinding or polishing by machinery, most of the work being cut with tools or smoothed with a file and emery cloth. Occasionally some parts are polished on cloth wheels, but this is done too infrequently to merit much attention.

Manufacture of Watches.

In the manufacture of watches, although a very large number of processes are carried on, there appear to be very few which involve any exposure to unhygienic influences that are worthy of much consideration.

The work is mainly very fine work, requiring sharp eyesight and unusual manual dexterity.

In a very large watch-making establishment it was noted that the principal objectionable feature is one which is not inherent to the industry, and far from necessary, namely, overcrowding. For example: one room, 185 by 24 by 10 feet, is occupied by 142 men, women and girls, and by large numbers of machines which take up considerable room; another room, 180 by 24 by 10 feet, is occupied by 132 men, women and girls, under the same conditions. In some of these large rooms it is most important to exclude dust, and therefore free ventilation from the outside is impossible; and, in consequence, the large number of persons present cause the air to be distinctly foul.

All of the rooms in which grinding and polishing machines are operated are very adequately ventilated by exhaust blowers, and no dust is perceptible in the air. In some of the rooms the grinding is done by the wet process.

In one small room, where one man treats dials with nitric acid, nitrous fumes are quite strong. In another, in which enamel is sifted and ground by one man, there is much fine dust, and the occupant wears a sponge over his nose; but the emery dust causes a condition of inflammation of the conjunctivæ. In another small room there is a strong odor of benzine, from the washing of small parts in washing machines containing that substance. In a number of other rooms fumes of benzine are observed to a greater or lesser extent.

In a number of rooms potassium cyanide is used with acid and alcohol in a process of cleaning small parts. This process is conducted under a hood equipped with a blower, and the fumes are effectively removed.

FILE CUTTING.

In the manufacture of files the workmen are exposed to a double danger, namely, exposure to metallic dusts and contact with metallic lead. The best files are cut by hand, no machine having as yet been invented which can produce their equal. The blanks are first ground smooth with the aid of stones, and in this operation considerable mineral and steel dust is caused. During the process of cutting the file lies on a base of lead, and the lines are cut by a chisel struck by a heavy hammer. The leaden bed offers sufficient resistance, while at the same time it is sufficiently yielding to prevent a sharp recoil. As the file is cut it is constantly brushed off, usually with the hand, which thereby becomes to a certain extent coated with very fine particles of lead, and the air becomes more or less impregnated with lead and steel dust. A common habit of file cutters in manipulating the file is to wet the finger and thumb with the tongue, thus conveying to the mouth particles of lead, which, through the acts of conscious and involuntary swallowing, gain access to the stomach. The work is very laborious, and the attitude which the workmen are obliged to assume is one which does not admit of normal respiratory movements, since they sit at a bench and stoop over the file.

The workmen of this class are notoriously careless, and are inclined to reject the idea that their calling is not free from danger; but, although in the establishments visited an occasional workman was observed to be pale and sickly in appearance, it must be admitted that as a class they looked well and strong.

Five shops of this class, employing from 5 to 70 persons (150 in all), presented reasonably good hygienic conditions. All showed fairly good ventilation, and but 2 were not well lighted. In 2, employing respectively 8 and 60 workmen, considerable dust was perceptible in the air.

THE JEWELRY INDUSTRY.

The manufacturing jewelry business in Massachusetts is for the most part centralized in an area which includes the adjoining towns of Attleborough, North Attleborough, Plainville, Norton and Mansfield. In Attleborough it gives employment to between 6,000 and 7,000 persons, in North Attleborough to between 4,000 and 5,000, and in the other towns mentioned to hundreds more. In Attleborough the number of establishments visited was 57; in North Attleborough, 38; in Plainville, 5; in Norton (Chartley), 3; in Mansfield, 2. Outside of this area, the only establishment visited was 1 in Leominster. The great majority of the employees are native born, Irish, and French Canadians, in the order given. Generally speaking, they are a sober, industrious and intelligent class, and a large proportion of them own their homes. Many of them are persons of good education, and their homes show abundant evidence of taste and refinement. In general, their appearance is healthy, and many who have followed the industry for twenty and more years speak of the work as being entirely consistent with good health.

In this industry the processes conducted are necessarily numerous, but for the purpose of this report only a few of the most important need be described.

Whatever the kind of jewelry to be made, the basis is what is known as "flat stock," made by "sweating on" bars of gold, usually of 12 carats, to bars of the same width of brass. The bars, with silver solder interposed, are clamped together and heated in a gas furnace to a cherry-red heat, when they unite. The resulting bar can be rolled to any desired thickness, the gold spreading equally with the brass, so that when down to .005 the stock assays the same as the bar before rolling. From this "flat stock" both tubing and wire may be made, from which are manufactured chains of all descriptions, bracelets, slides and ornaments of various kinds.

In making such an article as a fob top, which may be taken as a type, a piece of flat stock is struck with a steel die according to the pattern desired, then taken to a press and cut out in a steel cutter. The several parts are next put together and soldered into the desired shape, the plate being coated with boric acid before the application of the solder, in order to oxidize the surface and keep it from turning green. After soldering, the piece is placed in a "pickling" solution, which consists usually of a solution of sulphuric acid of about 20 per cent. strength, but it may be as weak as 5 per cent. This removes all of the boric acid. As the pickle gives off no fumes, even though it is used hot, this work is done with entire safety in the open room.

The piece is next polished with cotton cloth wheels and bristle brushes, the dust being drawn away by means of suction pipes and collected under water, and the gold ultimately recovered. The process, being dustless, is not detrimental to health. The piece is now ready for the coloring solution, which consists of a weak solution of potassium cyanide and gold, kept very hot and commonly uncovered. This gives a slight coating of 24-carat gold, which serves to bring out the depth of color for relief and to give a finished appearance, but has no wearing qualities.

Brass goods are plated by "dipping," but first they must be cleaned with acids. Silver is also treated with acids, to remove fire stains. The acids used include nitric, hydrochloric and sulphuric, chiefly the first two mentioned. In most factories these acids, which work more quickly when heated, are kept in hoods with exhaust ventilation, to prevent the escape of the fumes. Generally this work is in charge of one man, but occasionally two, three or four are employed. After "dipping" in the electro-plating solution no polishing is done, this process being too expensive for brass goods; but lacquers of one kind or another are applied, to prevent tarnishing. Lacquers are used also on silver, but never on rolled plate.

Lacquers are of secret composition, but are said to contain gun cotton, ether, amyl alcohol and other substances, and are very inflammable. The fumes are disagreeable, and, as the work requires heat up to about 100° F., it is not inviting.

The machinery in use in this industry includes power presses, foot presses, stamps, rolling mills, drills, large and small lathes, milling machines, grinding machines, planers, grindstones, emery wheels and polishing wheels.

Employees occasionally, through carelessness, get their fingers caught under the presses and stamps, and their finger tips cut or crushed. The rolling mills and other heavy machinery are operated by men. In some factories young girls work the light foot presses, and it is asserted by not a few that they accomplish more in a day than men, and do it more cheaply. The presses require but little physical exertion, and the foot swings about 8 inches. In the department where these machines are operated there are no fumes and no dust.

Ventilation and Light. — The most modern shops have large windows, extending from the tops of the benches upward to transoms of good size, and the light is often so strong in the faces of the employees as to necessitate the use of eyeshades. While only an occasional shop is equipped with mechanical ventilating apparatus, most of them have plenty of windows of average size, which are freely movable for purposes of ventilation. In one of the largest factories the benches are placed at a distance from the windows, and the employees complain of poor light; and in the same establishment the upper windows are fastened so as to be immovable, and the ventilation in winter is reduced to a minimum.

The Spitting Habit. — The habit of spitting is confined chiefly to the users of chewing tobacco, for whom in most of the establishments spittoons are provided.

THE LEAD INDUSTRY.

Lead compounds are manufactured by somewhat different processes in different establishments, and the several factories visited will therefore be considered separately.

In one, where from 15 to 20 men are employed in making white lead, pig lead is melted and cast into "buckles" or rounded perforated sheets about 5 inches in diameter. These are placed in large earthen jars or crucibles, containing acetic acid, which are arranged, in layers alternating with tan bark, in stacks, which are large compartments about 30 by 30 by 40 feet, open at the top under the roof of the building. The stacks are completely filled, and then the material is left for several weeks while the process of corrosion goes on. Considerable heat and carbon dioxide are generated, and the lead is converted to hydrated carbonate.

When corrosion is complete the tan bark is removed, and the layers of crucibles are emptied into small carts. As the contents are dry, crumbly scales and crusts, the process of emptying is accompanied by much dust, against the inhalation of which no precautions are taken by the use of respirators.

The product is taken to the grinding apparatus, where at once it is wet thoroughly and then kept tightly covered. The men who attend the grinding machines are of a different class from those who empty the stacks, and, since they are not exposed to lead dust, they do not suffer from lead poisoning and are comparatively healthy. Those who empty the stacks do not remain long at work. It is said that this is due in part to the disagreeable nature of the work, in part to the fact that they are largely roving characters who do not care to work more than a few days occasionally, and in part to the fact that they acquire lead poisoning and are obliged to quit. Even those of good intention rarely work more than a month.

After the material is ground, it is conducted in the wet state through pipes to the top floor, where it is discharged to a depth of 6 inches into beds which have an area of about 40 by 6 feet. The lead compound settles, the water is drained off, and the residue is dried by steam heat. When it is sufficiently but not absolutely dry, it is shovelled in the form of large lumps into trucks (in which operation considerable very fine dust is given off), and removed for packing into kegs and other containers or for grinding with linseed oil.

In a near-by abandoned tenement house are rooms set apart for washing, dressing and eating. Here everything is exceedingly dirty. There are two small sinks with running water, and hot water is obtained by heating in a pan on the stove. Because the workmen carry it away, no soap is provided, and the men must for a like reason provide their own towels. In warm weather the men eat their dinner out of doors; in winter, in the dirty room therefor provided.

In another establishment white lead is made by the wet process. Metallic lead is melted and poured from a height of 15 feet into water, the result being granulated lead. This is placed in cylinders and treated with acetic acid, which is kept in motion by constant pumping. The various processes are carried on with no evolution of dust, and the final product is filtered out, washed with water and ground in oil. All of the employees are healthy in appearance, and there is no history of lead poisoning.

In an establishment where red lead is manufactured, pig lead is melted in a series of furnaces over coal fires in a long brick building, with good light and ventilation. The men who attend the furnaces rake the lead at proper intervals with long iron bars, standing back some 20 feet from the furnace doors, thus avoiding fumes and dust. Once a day the furnaces are emptied into iron barrows, and the oxidized product is then transferred to a mill, which shifts and grinds simultaneously. All dust from this mill is forced by a blower-fan through a conduit to a room above, which is provided with cloth partitions. The final product is packed into casks without the creation of much appreciable dust.

All of the 17 men employed are mindful of the dangers incident to lead working, and have had from six to twenty-five years' experience. All seem well and strong, and none has had any sickness which can be attributed to the nature of the occupation during the period of his employment.

In another factory, where 8 men are employed in two shifts, pig lead, and sometimes white lead of inferior quality, is heated in large furnaces, which from time to time are opened for the purpose of stirring the material with an iron bar. After about twenty-four hours the resulting oxide is drawn off into iron barrows, and during this process the air is filled with fine dust; but the workmen are protected therefrom by caps, canvas jackets and cloths wound about their necks, and all wear respirators.

The material, after treatment with water, is screened and then sent to the grinding room, where it is thoroughly ground with water. The mixture of water and oxide is pumped to the fourth story to a large tank, where it is allowed to settle. The oxide is then separated and carried to the drying room, where it is spread on large, steam-heated tables, from which, when dry, it is scraped and transferred to a mill, in which it is reduced to a powder. It is then sent through canvas tubes to barrels for shipment. During the processes of transfer to the mill and packing into barrels more or less dust escapes into the air, but the persons exposed thereto are protected by respirators. Each man exercises due diligence against the possibility of poisoning, and before leaving the establishment washes carefully and changes all his clothes.

In a lead paint grinding establishment, where 24 men are employed, the dry material is mixed with linseed oil, the workmen avoiding as much as possible the creation of dust. The machines in which the mixing is done discharge through pipes to the grinding machines on the floor below; these require no great attention. The final product is filled into cans and other containers. On the day of visit no dust whatever was perceptible, and none of the employees showed any evidence of poor condition.

In another establishment, where among other materials about two barrels of white lead are used per month, all of the 40 employees appear to be in good health, and the conditions everywhere were found to be commendable.

In another, where various kinds of paints are ground, lead is gradually being supplanted by zinc oxide. When white lead is used, it is shovelled dry into the mixers with oil. No cases of lead poisoning have occurred at this place.

The 18 men and 3 women, the latter engaged in labelling cans and kegs, appear to be in good health.

MANUFACTURE OF LEAD PIPE AND PLUMBERS' SUPPLIES, ETC.

In the operation of melting lead in hooded furnaces and running it through the proper dies and moulds, lead fumes are given off in abundance; but, in factories in which the health of the workmen is properly safeguarded, these are carried away by hoods and exhaust pipes. In all 5 of the lead-casting establishments visited, in Boston, Holyoke and Westfield, all of which were found to be fairly or well lighted and ventilated, all of the employees appeared to be in good health, and in no instance was it possible to trace a case of lead poisoning to conditions obtaining or processes followed. While it was observed that it is the custom to handle lead with bare hands, the workmen, generally men of experience and intelligence, appeared to observe the necessary precautions as to personal cleanliness against acquiring lead poisoning.

In the largest of the casting rooms visited 54 men and 12 women are employed, and all appear to be in good health.

MANUFACTURE OF SOLDER.

In making solder, tin and lead dross are mixed with resin and charcoal, and heated in a furnace covered with a hood. After sufficient melting and stirring, the product is drawn off into a small pot furnace, dipped out with ladles and run into moulds. In an experience of thirty-five years but one case of lead poisoning has been known in the small establishment in which this work is conducted, and he was a worker in lead before he came. In this establishment it is noticed by the employees that no rats are ever seen, and the workmen who have attempted to keep dogs or cats have lost them very soon by lead poisoning. The men are very careful to wash thoroughly before going to meals.

POTTERY.

The pottery industry in Massachusetts is one of no great extent, and but 6 establishments were visited; these are situated in East Boston, South Boston, Dorchester, Cambridge, Dedham and Chelsea. The number of persons employed ranges from less than a dozen to somewhat more than 150. The products include all grades, from common flower pots to the highest quality of fancy pottery and crackle ware.

The process which is recognized in the great pottery centers of Europe as the most important from a sanitary standpoint is that which brings the employees in contact with lead, which is one of the principal ingredients of the mixtures used in glazing. These mixtures are of various kinds, and contain variable amounts of lead in several forms, the least harmful of which is known as "fritted." The glazes employed in the establishments visited contain lead in one form or another, with one exception, and this is a secret mixture. In one establishment fritted lead alone is used. While lead poisoning is a common condition in the great French and English potteries, it is almost unknown in the 6 home establishments visited. In 1 one of them, it is said, there were two cases several years ago in the case of two girls who applied the glaze; but in 3 of them the men who mix the glaze and are more exposed to possible danger than others who handle it have performed the work for from ten to thirty years without injury to their health or to their healthy appearance. It is to be said, however, that the persons engaged in this industry appear to be of good intelligence, and understand thoroughly the importance of care and strict personal cleanliness, and that the employers provide ample means for its maintenance.

In certain of the processes considerable dust arises, but these are not continuous, and the persons exposed thereto appear to have suffered no injury.

In all of the 6 establishments the conditions as to light and ventilation are good, what machinery there is is well guarded, and with two exceptions the toilet arrangements are excellent. In one the closets are unclean, and in one they are filthy.

In each place the general health of the employees is noticeably good.

PIANO MAKING.

In the manufacture of pianos many (some 30 or more) separate processes are conducted, but very few are attended by any possible danger to health. These include planing, polishing, varnishing and bronzing. In the operation of planing and polishing wood considerable fine dust may be given off, but in model establishments this is carried away by efficient exhaust ventilation. In polishing and buffing metal parts on emery and buffing wheels the usual dusts arise, but with mechanical ventilation these, too, are effectively removed. Bronzing is always a dusty process, in spite of all precautions, but the number of men who are engaged therein is not large. Varnishing and fine polishing are conducted in practically dust-proof and consequently not well-ventilated rooms.

Two piano factories, one situated in Cambridge and employing 300 persons, the other in Boston, employing about 500, were visited. Both occupy large, well-lighted and in general well-ventilated buildings. In both ample provision is made for the removal of dusts of all kinds, and the rooms are practically dust-free, except that in one, where 4 men use emery and buffing wheels, the exhaust draft is somewhat poor and at times there is considerable dust; and in another, in which woodworking is conducted, the hoods and exhaust pipes are only partially effective.

In the varnishing departments, which, as stated, must be kept free from dust, and hence cannot be freely ventilated, there are fumes of wood alcohol, but the number of persons exposed thereto is not great.

In one the bronzing is done by one man, who has worked constantly for twenty years, and states that, although he knows that he has some form of chronic poisoning, he suffers little therefrom. Formerly he wore a respirator, but he abandoned its use because it made a green line on his face. While he is very careful to wash thoroughly every day, he looks pale, has greenish discolored gums, and shows the effects of his calling.

In one there was noticed but little spitting, and in the other none at all. In the latter are posted notices regarding the danger of the spitting habit to health.

In both the rooms are very large, and each employee has an abundance of air space.

Lithographing.

In the lithographing business there are many processes, but most of them are devoid of any danger to health, and only those which are attended by possible danger will be considered. One large establishment devoted to this industry, employing about 700 persons, was visited. The work is conducted in many rooms, mostly large, in a number of large brick and wooden buildings. Almost all of the rooms are low studded, badly lighted and inadequately ventilated.

In the process of etching zinc plates, in which process nitric acid, diluted with about a fourth of its volume of water, is used, nitrous fumes are given off in such amounts as sometimes to be very troublesome, there being no hoods and no artificial ventilation. In winter the workmen not infrequently break the windows, in order to get fresh air.

In the rooms in which prints are made from the zinc plates and the lithograph stones — 2 rooms, 200 by 50 feet, occupied respectively by 75 and 175 men — there are strong odors of turpentine, etc., and the air is very bad, in spite of the fact that the vacuum system of artificial ventilation is employed.

In the operation of bronzing, which is conducted in a room 40 by 35 feet, occupied by 8 men, the sheets are run through a press, which prints the design in sizing, and then they are fed into bronzing machines, from which, in spite of their metallic coverings, the bronze powder escapes freely into the air. The boys who run the 5 machines wear handkerchiefs over the nose and mouth. They look pale and unhealthy, and all show the characteristic green perspiration due to contact with bronze.

In one side of the room is an exhaust ventilation fan connected with a wooden flue. This helps the ventilation considerably, but in spite thereof the air is heavy with bronze dust most of the time.

In the finishing room, 200 by 80 feet, occupied by 135 to 200 employees, mostly women and girls, where the operations of folding, perforating, pasting, cutting and embossing, etc., are carried on, the air and light are rather poor. Mechanical ventilating apparatus has been installed, but has not yet been given a fair trial.

The great majority of the employees appear to be healthy.

MANUFACTURE OF CHEMICALS.

In the manufacture of chemicals, as carried on in the largest establishments of the State, a great variety of substances are produced, and necessarily a great variety of processes are required. The chemicals which are associated in the public mind with possible dangers, namely, the corrosive acids, are, as a matter of fact, made in such a way that in the several processes practically no fumes whatever escape, the work being enclosed from beginning to end.

A number of processes which give rise to poisonous and irritating fumes are very commonly conducted in the open air, or in sheds with open sides and ends.

In the largest of the chemical factories visited about 300 men are employed, and a great variety of chemicals are manufactured. The work is conducted in large, well-lighted, adequately ventilated buildings, in which all belting and shafting are well guarded.

The important processes, carried on on a large scale, occupy separate buildings, and the products are in the main not exposed at all to the air.

The workmen, all of whom are adults, are exposed very little to poisonous or irritating fumes and dust, or contact with poisonous or irritating substances; but at certain points in the buildings acid fumes in considerable strength are constantly present, but at these points there is good overhead ventilation, and the workmen are rarely obliged to approach very near thereto.

In this establishment very little spitting was observed, and the general appearance of the employees was healthy.

The conditions obtaining in another somewhat smaller establishment, engaged in practically the same line of work, were found to be equally commendable.

In 3 other establishments, manufacturing the same line of goods, but to a much smaller extent, each employing less than 20 men, the conditions as to light, ventilation, absence of fumes and dust were found to be such as to deserve no criticism. In each the workmen appear to be in good health.

Among the products of the above-mentioned factories may be mentioned sulphuric acid, hydrochloric acid, acetic acid, nitric aid, ammonia, sodium sulphide, sodium sulphate, alum, potassium cyanide, ferrous sulphate, sodium bisulphite, sodium carbonate, sodium bisulphate, ferric chloride, ferric nitrate, stannous chloride, sodium acetate, aluminum chloride, and various salts of tin, arsenic, antimony, zinc, copper, etc.

In addition to the establishments mentioned, the following, devoted to the manufacture of special lines, may be described: —

Manufacture of Potassium Cyanide.

A. In an isolated wooden building, 40 by 50 by 30 feet, the product is fused in crucibles and cast in moulds. The fumes are carried away by means of a hood connected with a chimney.

Manufacture of Arsenate of Lead.

B. Establishment employing 5 or 6 men, in a room 50 by 20 by 10 feet, adequately lighted and ventilated, in the manufacture of arsenate of lead from nitrate of lead and arsenate of sodium. The demand for this product is such that it is made only occasionally, and when ordered is filled into small containers for delivery. No objectionable features were observed.

Manufacture of Lactic Acid.

C. Fifteen men engaged in the manufacture of lactic acid, in a fairly lighted and ventilated building. The machinery is well guarded. The appearance of the men is healthy.

Distillation of Tar.

D. Establishment employing from 50 to 100 men in the distillation of tar. In this process the crude tar from gas works is treated in large, out-door distilling apparatus. The first distillate is "light oil" or crude naphtha; the next are heavier oils, from which certain disinfectants and stains are derived; and, finally, "dead oil," "heavy oil" or "crude oil." The residue is the product known as roofing tar and paving tar.

The process, being carried on in the open air, is devoid of the usual objectionable features of occupations in which poisonous, irritating or offensive fumes are given off.

In this establishment all of the employees appear to enjoy good health.

E. A small establishment, employing 60 men, distilling coal tar. The conditions same as under D.

Manufacture of Lampblack.

F. Department of factory designated as "E," in which a half-dozen men produce lampblack, by burning heavy oil and drawing the smoke through a series of brick chimneys. The fires are shut off in the morning, and the men draw out the product with wooden scrapers. It is next taken up a screw elevator to a mill, which grinds and sifts it. It is finally packed in barrels or paper bags.

The men object to the use of respirators, and are covered with soot.

Manufacture of Bone Black.

G. Establishment employing 20 men. Calcined bone is ground in mills on the lower floors of two fairly large wooden buildings, and the resulting powder is blown by fans through conduits which lead to the floor above. From the conduits the powder is delivered into large cloth bags, from which it is drawn through appropriate openings into barrels.

The air is laden with dust, but the workmen refuse to wear respirators. They look fairly healthy.

Manufacture of Facing for Foundry Use.

H. Charcoal and graphite of several kinds, known as "Rhode Island lead" (Providence, R. I.), "German lead" (from Austria) and "silver lead" (from Ceylon), are ground, sifted and mixed by machinery; and from each of the machines employed in the several processes large volumes of extremely fine black dust are given off. The materials are sent from room to room and from floor to floor through chutes or "runs," and, as the dust is so fine that, according to the men engaged, it will sift through anything that is not water-tight, the entire building is so permeated with it that a person entering the place becomes covered with it almost immediately. The 7 workmen say that they get accustomed to the dust, and that they are only occasionally troubled by it. They appear to be in fair health, but rather poorly nourished.

Manufacture of Stove Polish.

I. Establishment employing 27 women and 18 men. Ceylon graphite is crushed and ground by machinery in the basement, and the product is sent to bins in the third story through a wooden conduit. Very fine dust is given off from the machine, and it passes through every crack and crevice, so that the entire atmosphere of the building is heavily dust-laden. From the bins the fine powder is sent down when and where needed, and is mixed with water to form a paste, part of which is packed as such by girls and women into tin boxes, the rest being made into cakes and dried in an oven. The man who is most exposed to the dust has worked about eight years, and, while he dislikes to inhale it, he is not conscious of being injured by constant contact. He states that he cannot wear a respirator with comfort, since it interferes with deep breathing, which the severity of the work calls for.

The workmen are provided with bath tubs and a plentiful supply of hot water. The men appear to enjoy fair health, but the women and girls, who are being gradually supplanted by men, compare somewhat unfavorably.

Manufacture of Stains and Blackings.

J. About 75 men, employed in well lighted and ventilated, scrupulously clean wooden buildings. The machinery is well guarded. The materials used include naphtha, wood alcohol, grain alcohol, borax, soap, shellac, Venetian red and nigrosine.

"Spirit blacking" is made in a shed with roof ventilation. About 50 gallons of naphtha with black pigments are used daily. Strong naphtha fumes are given off during the hour or two which the work requires each day, but they are rapidly removed.

In another building, 25 by 100 feet, 3 men are employed mixing saponified solutions of gums colored with nigrosine and other coloring agents, and cooking the mixture in large steam kettles, provided with hoods which can be drawn tightly over them and connected with large exhaust flues. Here shellac is also agitated with wood alcohol. The fumes in this department are troublesome only when the mixture is drawn off into small cans.

Shingle Stains.

K. Shingle stains are made by mixing "heavy oil" and various pigments. In some places they are made with "light oils." The pigments, such as Prussian blue, chromate of lead, zinc oxide and iron oxide, are first mixed or ground with linseed oil, then with creosote, and finally barrelled.

Two establishments were visited, and in both the men appeared to be careless in the matter of contact with the pigments.

Shoe Blacking and Polishes.

L. In the manufacture of shoe blackings and polishes a number of ingredients are used, including Brazilian wax, paraffin, shellac, borax, glue, ammonia, nigrosine, turpentine, grain alcohol, soap, etc., the materials used varying, of course, according to the product and to individual formulas. The ingredients are mixed by churning in barrels or by heating in cauldrons or jacketted kettles. The various pastes which are made with the aid of heat are poured into tins or other appropriate receptacles, and their cooling is hastened in some instances by fanning. When turpentine or ammonia is used as one of the constituents, fumes thereof are liberated to some extent, but, so far as appears, not in sufficient volume to cause appreciable injury or discomfort. The liquid preparations while being poured into bottles give off, as a rule, no fumes whatever.

Seven establishments in Boston, employing from 3 to 15 persons, and 1 in Cambridge, employing 37 men and 150 girls and women, were examined. All were found to be adequately lighted and properly ventilated, and in each instance the washing facilities and water-closets were good, or at least fair. The spitting habit was but little in evidence, and in the largest of the establishments was noticed not at all. In all, and especially in the largest, the general condition as to cleanliness was excellent; and in all the employees presented a healthy appearance.

Manufacture of Varnishes, Paints and Colors.

M. Well lighted and ventilated establishment, employing 13 men. The materials used include alum, sal soda, Prussian blue, anilin, white lead, ultramarine, Paris green, ferrous sulphate, barium chloride, potassium ferrocyanide, tartaric acid, etc. The products are oil paints, varnishes, dry colors and coloring pastes. A considerable portion of the work is done out of doors. The men engaged have worked for from six to twenty years. The man who makes the lead colors has worked seventeen years without sickness. The last cases of poisoning at this establishment occurred sixteen years ago, when a number of inexperienced men were poisoned with Paris green.

The machinery is well guarded.

Varnishes. — In the larger of the two varnish factories examined 80 people are employed. The light, ventilation and toilet arrangements are all commendable. The machinery is well guarded. A chemical black varnish is made in large kettles, which contain automatic agitators. Among the ingredients is naphtha. After several hours' cooking and agitation, the varnish is drawn off and placed in storage.

In the smaller of the two, 7 men are employed. The ventilation and light are fair. There is but little machinery. The materials used include gums and oils. These are cooked in large kettles over coal fires, and the contents when cooled are pumped through pipes to settling tanks, where they remain in storage several weeks. Each of the kettles is enclosed in a brick compartment, through which the fumes are conducted to the chimney. Occasionally a kettle catches fire, but no harm results, because of the brick enclosure.

Colors and Mordants.

N. Establishment employing 27 men, the majority of whom appear to be in good health, but inflamed conjunctivæ were observed to be not uncommon. About one in five of the employees is noticeably pale and sallow. The materials used are anilin colors, logwood, starch, sodium dichromate, etc. It is to the sodium dichromate that the inflammatory condition referred to is due. Considerable starch dust was observed in the air.

Manufacture of Whiting.

O. In the manufacture of whiting, chalk rock, imported from Engand, is first dried, or treated with water and then dried, and next ground to powder in crushing machines, which give off much fine powder to the air. The operations of sifting and packing are naturally even more dusty than the process of grinding.

Three establishments were visited. In all 3, the workmen, 58 in all, have ample cubic space in fairly well-lighted rooms, the air of which on the day of visit was filled with fine dust. The workmen were covered with dust, and, independent of the unnatural white appearance caused thereby, about half looked to be in poor condition.

The habit of promiscuous spitting was observed to be fairly general.

Manufacture of Bluing.

P. In the single bluing factory visited 20 persons are employed. The materials used are prussiate of potash, ferrous sulphate and nitric acid. The first dry product is ground in a mill, which is well boxed in, and but little dust escapes. The powder is marketed in part as such, and in part in solution in water. The boxing and bottling are done by men and women in rooms of good size, which are light, clean and adequately ventilated. All of the employees appear to enjoy fair or good health.

Manufacture of Viscoloid.

Q. Viscoloid is very much the same thing as celluloid, and its manufacture can justly be regarded as a dangerous operation, since one of the processes involved is the manufacture of gun cotton, which is the essential component. In the only establishment devoted to this industry this substance is made in a large, light room, 72 by 30 feet, in which is a large hood with artificial ventilation for the removal of the fumes of the acids employed. The gun cotton produced is mixed with wood alcohol and camphor in a large room, which is properly ventilated. The stock is seasoned in a separate building, in which a temperature of 98° F. is maintained.

The factory is kept scrupulously clean, and is well provided with sprinklers, extinguishers and water pails, for use in case of fire. Spitting is prohibited, as is also the bringing in of matches.

BLEACHING AND DYEING.

Cotton cloth, as it comes from the mills, is unbaled and sewed together into long strips, which are wound on rolls by machinery. In this process considerable fine lint dust ("flue," "fly") is given off. The strips pass through the "gray room," where they are exposed to the action of non-luminous gas flames, which singe off the lint. Next the cloth is passed successively through a boiling, weak solution of caustic soda or lime, a boiling solution of sodium carbonate (washing soda), a mixture of water and bleaching powder ("chloride of lime," "chlorinated lime"), and lastly dilute sulphuric acid, and then is washed thoroughly with water, dried between steam-heated rollers, stretched, starched, calendered and folded by machinery.

In all 5 bleacheries visited, employing from 60 to 475 persons (about 1,200 in all), the light, ventilation, general cleanliness and toilet rooms are at least fair, and usually good. The machinery was found to be adequately guarded, and in each establishment the steam arising in the processes of washing and drying is removed more or less thoroughly by means of exhaust blowers. In one instance, however, in spite of the action of six large exhaust fans, the amount of condensed steam present in the air at the time of visit (a stormy day) was such that one could see not more than three to six feet in any direction.

In one of the establishments the persons exposed to the lint dust which escapes during unbaling and stitching together all looked pale and sickly, but with this exception the employees presented generally a healthy appearance.

The odors of bleaching powder, although observable in each of the rooms where that substance is employed, were in no case so strong as to be disagreeable or to cause discomfort.

In the dyeing and printing departments the employees are subjected to the influence of no objectionable substances, the colors of whatever nature coming but very little into direct contact with the operatives. The mixing of colors is done by a very small number of men, and such as require heat are treated in steam-jacketted kettles connected with exhaust flues. There is some disagreeable odor connected with the mixing and application of colors, but, like most merely offensive, not irritating smells, it appears not to interfere with health.

DYEING AND CLEANSING.

In a large dyeing and cleansing establishment, situated in the town of Watertown, a very wide variety of processes are conducted and many different chemical substances are employed. The latter include naphtha, gasolene, wood alcohol, ammonia; various acids, including acetic, oxalic, sulphuric and hydrochloric; bleaching agents, including chlorinated lime, hydrogen peroxide and sodium bisulphite; iron salts, including nitrate, acetate and sulphate; copper sulphate, borax, alum, sodium carbonate and sulphate, potassium permanganate and cyanide, caustic potash, soap, anilin dyes and other dyestuffs.

The buildings comprise a large new brick and cement fire-proof structure, a less modern brick and wooden building, and a wooden laundry. These are light and well ventilated, and are provided with modern toilet conveniences in fair to good condition.

All goods are received in a checking room, 60 by 40 feet, in which 10 to 15 women and girls mark and check each piece. From this room the pieces are distributed to the several departments. In what is known as the "spot room," which is 120 by 25 feet, 10 men and 3 girls remove spots by means of naphtha, wood alcohol, ammonia and other agents, which are applied with pieces of cloth. The ventilation here is distinctly good.

In a large wash room, 65 by 30 feet, 10 or 12 men are employed washing goods in large tanks and vats. This has a brick floor, which drains well and quickly, and it is equipped with a 28-inch fan to assist the ventilation. The room is clean, and free from vapors.

The room in which 5 to 10 women do small repairing is somewhat overcrowded, but it is clean, light and well ventilated.

The folding room, glove room and shipping rooms are open to no objections. The drying room, in which goods are hung for several hours after cleansing or washing, is kept at a temperature of somewhat higher than 100° F., but nobody works here for any length of time.

From 50 to 75 persons are employed in the several pressing rooms, the lace room and the curtain room, which are commodious, light and well ventilated. In the pressing rooms gasolene gas is used for heating the irons, and this causes more or less odor of vaporized gasolene, especially in cold weather, when the windows are closed, and this is exceedingly irritating to the eyes and respiratory passages when sufficiently strong. The occupants of these rooms, however, appear to be in good health.

In the naphtha-cleansing department, occupied by 6 to 8 men, are a number of washing machines, filled with naphtha and ammonia, in which clothing, gloves, etc., are cleansed. The means for fire-protection are ample and adequate, and there is also installed a system of mechanical ventilation which does much to reduce the amount of naphtha and ammonia fumes in the air. In spite of all precautions, however, there is a strong odor of naphtha, and all of the men here employed are pale and some of them very markedly sick looking.

In the room in which the naphtha-cleansed goods are dried, at a temperature of about 120° F., the naphtha fumes are very strong. Although the men who bring in the goods remain but a few minutes, some have occasionally been temporarily overcome by the fumes, and have shown the characteristic excitement and hysterical symptoms of naphtha intoxication. At the time of visit, the man who does most of this work had been engaged thereat for three months, and had experienced no ill effects.

The dyeing department is clean, light and well ventilated. The sloping floor is of brick, and drains rapidly to the sewer. The 10 occupants appear to suffer no discomfort.

In the rug and carpet cleaning department there is a large enclosed dusting machine, which is equipped with a fan and dust flues, through which the lighter dust is carried away. The heavy dust and dirt fall to the bottom, and are removed at short intervals after being covered with chlorinated lime. The work here is rather dusty, but the several workmen show no ill effects therefrom.

THE RUBBER INDUSTRY.

In the 14 rubber factories visited in the course of this investigation, of which number 5 are very small, and employ less than 50 persons each, about 9,000 persons, mainly below forty years of age, and about evenly divided as to sex, are given employment. In these establishments are manufactured rubber boots and shoes, rubber cloth and clothing, cotton and rubber goods, " electric " tape, rubber heels and other hard and soft rubber articles; but the majority of the persons employed are engaged in the manufacture of boots and shoes, and no fewer than from 2,600 to 3,100 work in a single factory, situated in Watertown, which is the largest of its kind in the world.

Following are the processes followed in the manufacture of rubber footwear and cloth: —

Treatment of Crude Rubber. — The large cakes of crude rubber are broken up by a "cracker" machine, consisting of two large revolving steel cylinders, from which the product falls into pans or trays. It goes then to a machine known as a "washer" or "sheeter," where it is run between revolving cylinders, upon which a continuous spray of clean water is maintained. After being rolled into rough sheets, it is put into a tank, from which it is taken to the "beater" machine, in which water runs continuously, and then it is washed again and "sheeted out."

Calendering. — The sheets of rubber after being dried are taken to the "compound" room, where they are sprinkled with whiting, to prevent sticking, and weighed. Next they are taken into the calender room to a "mixer," by which the rubber is mixed with other substances, which include sulphur, litharge, whiting, lampblack, tar, resin, lime, palm oil and linseed oil. The next machine is known as a "refiner."

The rubber in the state in which it exists at this stage of manufacture goes to the calenders in company with cotton cloth, jersey, duck or other kinds of cloth, which has been heated by means of a cloth-drying machine. One of these large calenders has four great cylinders, one over another. The rubber passes between the two upper, and the cloth between the two lower rolls. The former emerges spread so thin that the thickness of the sheet cannot be gauged, and both come off together and are run into the cotton room. Similarly, the rubber as it comes off the calender rollers in long, thin sheets is run on a specially designed frame for bootleg covers and upper stock.

Cutting Uppers, Heels and Soles. — Heels are cut out of thick rubber by means of dies struck by heavy iron mallets. Uppers and soles are cut out partly by machine and partly by hand. The hand work requires great skill and deftness, and is performed by men. Boys cut small pieces used for reinforcing, and they roll out bootlegs and do other light work.

Cutting Linings. — Different kinds of cloth are used for linings. Whatever the kind, it is coated thinly with a cement of rubber dissolved in naphtha. After this is done it is wound into rolls. A roll is set up at the end of a long counter in such a way as to permit it to be unwound as desired. Thus a layer of rubber-coated cloth is drawn over the whole length of a very long, wide table (the cloth generally runs 54 inches wide); a layer of paper is then unwound over the rubber cloth, so that paper and cloth alternate until the desired number of layers is obtained. Generally, linings for nine pairs of shoes are cut at once. The linings are cut both by hand and by machine. Men who cut with dies, by hand, stand at the bench and use iron mallets like those used in cutting heels. Innersoles, heel pieces and linings are all cut by means of dies in the same manner.

Quartering and Cementing. — The edges of the several parts are spread with cement, and then the parts are taken to the making room and distributed.

Making. — In the making department the boots and shoes are put together. Women make the light overshoes, men make the heavy ones. Rubbers are made by women, but men put on the outer soles.

Linings are first applied smoothly to a wooden last and cemented together, the cement side out. The rubber parts are then stuck on and rolled firmly with a small hand roller. Young women become very skilled in this work, taking up the several parts in rapid succession, placing them accurately upon the last, and rolling and pounding them firmly together.

Perhaps the most interesting single process is that of putting the rubber boot together. This work is done by men, and requires, in addition to accurate eyesight, rapid and very deft movements of the hands and considerable strength.

Varnishing. — The goods which require varnishing are put on racks and treated with a mixture of boiled linseed oil, naphtha and other materials, which is applied with brushes, and imparts a gloss to the surface.

Vulcanizing. — The shoes or boots, placed on trucks, are sent into "heaters," where they are subjected to a temperature of 280° F. or higher, whereby the strength and elasticity of the rubber are increased.

Rubber Cloth Making. — The crude rubber is put through the washing process, dried and mixed with sulphur, litharge, coloring matter, etc., and then is taken to the cement room, where it is "cut" with naphtha, forming a thick paste or dough. This is taken to the spreading room in large tubs and fed into the roller machine, which is like a long table made of steam pipes placed horizontally in a single layer. Below one end is a roll of cloth, which is passed between two iron rollers on the end. The dough is fed in between these rollers and is spread smoothly over the cloth, which is rolled up and removed to a heating room, where it is unrolled and hung on racks, and then subjected to sufficient heat to cause combination of the sulphur and rubber (vulcanization).

"Electric" tape is merely strips of cloth spread with rubber cement.

Rubber heels are made in large part in the following manner. Rubber is ground finely in a mill, mixed with other gums, etc., and made into a paste with naphtha. The mixture is put into moulds and vulcanized in the usual way.

In former times the vulcanizing agent used was carbon disulphide, fumes of which are well known to be harmful in their effects upon the nervous system. Now it is used but seldom, and then only in small quantities and for special purposes.

In 11 of the 13 rubber factories visited, situated in Blackstone, Boston, Brockton, Cambridge, Chelsea, Malden, Melrose, Reading, Stoughton and Watertown, the odor of naphtha was noted as only slight, even in rooms in which that substance is extensively used; namely, quartering (where parts are cut out and edges are cemented), making (where the parts are assembled) and cement (where the cement is made). In 2 factories it was stated that a few girls, new to the work, show the effects of naphtha, and suffer from headache and sometimes nausea and vomiting, but that such girls do not long continue at the work. Naphtha fumes sometimes bring about a condition which much resembles alcoholic intoxication, and which occurs most often in the room where rubber is spread upon cloth. New men are especially susceptible, but even old hands have sometimes to leave their work at times for a breath of fresh air.

All of the establishments were found to be well lighted and adequately ventilated with one exception; and in this place the general conditions are far from satisfactory, there being, in addition to poor light and bad air, general uncleanliness and considerable dust.

In 6 factories, in which white lead or lead monoxide (litharge) is handled, no history could be obtained of any cases of lead poisoning, even among those who do the mixing. In 2 it was stated that cases occur, but not often. In 1 no lead compound is used; this is one of the smallest factories. The reason for employing lead is that its association with sulphur seems essential to the success of the latter as the vulcanizing agent.

In but two instances was machinery found to be inadequately guarded; in one the large gears of the calenders and in the other some right-angled gears on spreaders were unprotected.

In no factory were the toilet accommodations in distinctly bad condition.

MANUFACTURE OF STRAW HATS.

In the manufacture of straw hats are several processes which involve possible exposure of the workmen to unhygienic conditions. Among these are bleaching, varnishing, sizing, staining and blocking.

The bleaching of the straw is done with sulphur fumes. The sulphur is ignited in a kettle in a closed room, and to the resulting fumes is exposed the stock. Naturally, the employees are exposed to these fumes only when the doors are opened for the removal of the stock, but they do not enter until the fumes have escaped or have been driven out. In another process of bleaching the stock is immersed in a bath of water, bisulphate of sodium, zinc dust and hydrochloric acid. Other chemical agents are oxalic acid, tartaric acid, acetic acid, sodium peroxide and hydrogen peroxide. The braid is left in the bath for a certain number of hours, and is then taken away and put into the drying room. The workmen engaged in this process do not wear respirators, and those who were interviewed state that neither process causes anything more than a temporary irritation of the throat, and that many of them have worked in this department for many years.

The varnish used on straw hats is made of shellac cut with wood alcohol, and is applied to the straw braid with a brush. The fumes given off cause in some of the operatives a burning sensation in the eyes.

For stains, solutions of anilin dyes in wood alcohol are commonly used. Some hats are brushed over with a mixture of benzoin, camphor, anilin black and wood alcohol; some are covered with white shellac cut in wood alcohol; and, as in the varnishing processes, those who do this work are exposed to wood alcohol fumes. In the process of sizing with glue a high temperature is said to be necessary, in order that the glue may run off freely; this temperature is commonly about 100° F.

The largest of the 3 straw hat factories visited employs about 200 persons, mainly from twenty-five to thirty years of age. The buildings are in part poorly lighted, in part well lighted. Ventilation is adequate, and is provided by windows, air shafts and openings in the roof. In certain of the rooms ventilating fans are used. In the rooms in which wood alcohol is used the fumes were observed to be fairly strong.

The second largest of the 3 factories employs from 100 to 225 persons, according to the season. The buildings occupied are clean, well lighted and thoroughly ventilated. Very few manufacturing plants of any kind visited show such good conditions as to cleanliness, light, ventilation, toilet and wash rooms. The ceilings are high, and the walls and ceilings are whitewashed.

The drinking water is brought in from the outside, since the water with which the factory is supplied for general purposes is polluted and unfit to drink. The water taps bear, however, no warning notice concerning the character of the water, and the vessels containing the water from the outside are neither sufficiently numerous nor sufficiently accessible.

GLUE MAKING.

In the manufacture of glue, the materials, chiefly "fleshings" and hide scraps, are first washed in water, then placed in tanks with lime and water, in which they are left for several days, during which time the hair is loosened and detached. After removal from the tanks they are stored until wanted, when they are washed as free as possible from lime, and then placed in tubs and exposed to the action of steam. From time to time the liquor is drawn off from below and set away in pans to solidify to a hard jelly, which is cut into slices, and then transferred to screens and thoroughly dried. The dried product is then broken up and packed in barrels. Sometimes it is ground to powder in a mill, which creates some dust, which is harmless in effect if inhaled. The residue in the tubs is subjected to further treatment for grease, which is disposed of to tanners. The hair is dried by steam heat, and baled for use chiefly in plaster. In handling the hair much dust arises, and to protect themselves from its inhalation the men commonly wear handkerchiefs over their noses and mouths.

Gelatine is produced in the same manner as glue, but from a superior grade of stock.

Fish glue is made from the by-products of the fish-preserving industry, which are treated in large steam tanks. The liquor is drawn off, filtered and evaporated to the required consistency and bottled for shipment.

The manufacture of glue and gelatine is necessarily an offensive occupation, owing to the nature of the materials used; but experience has shown that it cannot be regarded as dangerous to health. In the 4 establishments visited, in Peabody, Stoneham, Woburn and Gloucester, in which from 25 to 200 persons are employed, the sanitary conditions were found to be beyond criticism excepting in one, where the privies were indescribably filthy. In every instance the appearance of the employees as to health was most excellent.

TANNING.

Most of the processes of tanning are very laborious, some of them are very wet, and all of them are to a greater or lesser extent offensive. The leather industry is one, therefore, that calls for strength and endurance.

To a considerable extent the so-called chemical process has supplanted the old tan-bark and sumac methods, but in some establishments both processes are carried on with different kinds of skins.

In the old-fashioned process the bark is ground coarsely, and the resulting "tan" is treated in vats with hot water, into which live steam is turned. The liquor so obtained is employed in various strengths as needed. In the newer method the tan liquor is displaced by a solution of potassium dichromate, which produces its results with much less expenditure of time.

Whichever process is followed, the preliminary work is the same. The hides are soaked first in water and then in water to which lime is added, and then they are removed from the vats for further treatment, which includes washing and removal of hair and a number of other processes, all of which involve exposure to wet, and are disagreeable, the odor of a "beam house" being commonly noticeable at considerable distances.

All of these processes demand the services of men of good physical strength. When the hides or skins are ready for the tanning process, which, whether "old-fashioned" or "chemical," is essentially and necessarily one of chemical change, they are placed either in a vat of bark liquor, in which they remain for a number of days or weeks, or they are put into a revolving drum, known as a "pin-wheel," or into a pit in which are revolving paddles, with a dilute solution of potassium dichromate or sodium dichromate, acidified with hydrochloric or sulphuric acid, and caused to revolve or to be overturned for seven hours or longer; after which time, if the pin-wheel is employed, the liquor is drawn off and replaced by an acidified solution of sodium thiosulphate or bisulphite, and then the revolution is continued several hours longer; and, if the pit is used, the skins are removed to another, containing the second solution, and kept at rest or overturned for a like period.

In removing the skins from the pin-wheel or vat and in handling them after treatment with lime for the loosening of the hair the hands and arms of the workmen are seriously injured, becoming raw if not protected by rubber gloves; but even with gloves it is difficult to prevent injury, and in some establishments the workmen are relieved by the substitution of a single-bath process, in which the liquor, present on its completion, exerts less effect upon the skin.

The later processes of leather manufacture are less laborious, though the work is heavy, and they involve far less exposure to dampness, but more to mechanical injury. In general, however, the unprotected parts of leather-making machinery need not be approached closely by the operatives. In the various processes of drying, stretching, stuffing, hand-whitening, blacking and polishing there are no features which are intrinsically dangerous to health in any way; but the process of buffing on wheels or revolving drums covered with sandpaper gives rise to considerable dust, which, even when exhaust fans are installed for its removal, escapes in most instances to a greater or lesser extent into the air of the room. In one of the establishments visited, for example, where every part was found to be kept scrupulously clean and neat, and where the beam house, ordinarily a most offensive place, was conspicuously clean and free from objectionable odors, the air of the buffing room was filled with fine dust.

In the manufacture of "patent" leather, which is largely a secret process, the workmen are exposed to fumes which, while far less disagreeable than the odors of the tanyard, are intrinsically dangerous. Thus, in one method employed, the leather receives first a coating of a mixture which contains, among other ingredients, amyl acetate, naphtha and wood alcohol, strong fumes of which substances are given off and are perceptible at considerable distances away. In one establishment, where, on account of ignorance, on the part of the examiner, of the Polish, Greek, Armenian and Syrian languages, and, on the part of the employees, of English, it was impossible to acquire information as to the possible effects of the combined fumes, it was admitted by those in authority that many employees cannot do the work on account of inability to withstand their influences. The basis of the material is linseed oil, which is mixed with the other ingredients in a revolving drum; the mixture is next heated in iron kettles connected with an exhaust flue. The final coating, which is applied with a brush, is a naphtha preparation resembling japanning material. The hide, stretched on a frame and treated, is transferred to a drying chamber, where it is exposed to a temperature of not much more than 100° F. The odor given off in this stage of manufacture is far less offensive than the fumes arising during the preceding process.

Eight tanning establishments, employing from 28 men, in one instance, to 1,100 in another, and about 2,300 in all, showed conditions which in the least pretentious were at least fairly commendable, and in the most approved were as praiseworthy as those met with in cleaner occupations. The business is one in which overcrowding is hardly possible and free ventilation most desirable; and, as is to be expected in a non-dusty trade, requiring strength and endurance, the employees are healthy appearing and well nourished. The only objectionable conditions noted were the dusty atmosphere incident to buffing, and exposure to fumes of naphtha, amyl acetate and wood alcohol.

Soap Making.

Soap making is properly classed as an offensive trade, since the nature of most of the materials used is such that in the most essential processes of manufacture foul odors are evolved to such an extent that the immediate neighborhood of an establishment engaged in the business is unsuited to residential purposes. The odors, while disagreeable in the extreme to those unaccustomed thereto, as an incident to their daily employment do not conduce to disease, and it is well known that the employees, as a rule, enjoy good health.

Of the 10 soap factories visited, one of which employs more than 150 persons, about half of whom are girls of about eighteen years of age, all showed general conditions as to light, ventilation and cleanliness which may be classed as fair, and several, considering the nature of the occupation, as distinctly good. In not one did the employees as a class appear otherwise than in good health.

Rendering and Fertilizer Making.

The rendering and fertilizer-making establishments are, as a rule, situated as far as possible from human habitations, on account of the nauseous odors which are inevitable concomitants of the business. In ordinary rendering the materials used are fat, meat trimmings, bones, etc., the products are oils, grease and "tankage," and the processes employed are so conducted as to reduce as much as possible the amount of offensive odors which escape into the air and render the immediate vicinity undesirable for residential purposes. The fumes given off are in no sense dangerous to health, although highly disagreeable; and, except in certain processes of handling dried tankage, there is no great exposure of the workmen to dust, — what dust there is, is, moreover, of the most harmless kind.

In all of the dozen rendering plants examined the general conditions as to cleanliness of rooms, light and ventilation were found to be at least fair, and in some instances excellent. The workmen presented, in general, the appearance of rugged health.

In the two largest fertilizer works visited, one in Weymouth, the other in Billerica, which employ respectively about 275 and 100 men, the materials from which the final product is made (tankage, garbage, slaughter-house refuse, bones, etc.), are boiled with dilute sulphuric acid in tanks properly covered and provided with flues which convey the fumes to condensers. In the process of dumping into the tanks some of the men wear cloths over the mouth and nose, but others do not. The product of the tanks is drawn off as a thick mass, which dries in a day or two to such an extent as to permit breaking up and grinding. In the operations of grinding and packing there is escape of more or less dust and fumes, but the men engaged therein appear to suffer no inconvenience therefrom, and some of them have been engaged at the work for long periods.

In one of these establishments the sulphuric acid used is manufactured on the premises in the usual manner, without exposure of the employees to any danger to health.

In both the general health of the workmen appeared to be good; but in one a certain proportion, mostly men of no fixed habits of work, engaged only temporarily and therefore not accustomed to the nauseous odors, looked pale and poorly nourished.

SLAUGHTERING AND PACKING.

Although Massachusetts is by no means prominent as a center of the slaughtering and packing industry, the annual value of her few large and many small establishments of this class is, according to the census of 1900, more than $30,000,000, or $8,000,000 greater than that of her paper industry, in which she leads the country, and $4,000,000 more than that of her leather industry, in which she stands second only to Pennsylvania.

All of the larger and 201 of the smaller slaughtering establishments have been examined; and, owing to the popular interest in and distrust of packing-house conditions and methods, caused by reports concerning certain of the very large establishments of Chicago, the results of the inquiry were published in the "Monthly Bulletin" of the Board. Inasmuch as the names of those whose conditions were found to be commendable have already once been made public, there seems to be no reason for suppressing them in this report, and they are therefore reproduced.

In the larger establishments but few conditions were found which merited criticism; but the great majority of small slaughterhouses, situated chiefly in the country districts, were found to be far from commendable, and many of them worthy of the severest condemnation. Of this class, 201 were visited, but it is not known how many exist. The authorities of 101 cities and towns reported that no slaughterhouses are maintained within their borders; those of 103 failed to reply to the Board's circular letter requesting information on this point, but 24 of these places were visited, and slaughterhouses were found in all but 7. Of the remaining places, 45, which, through lack of sufficient inspecting force, could not be visited, reported a total of 114. Thus there are known to be 315 small slaughterhouses, with 79 towns not heard from. Of the 201 examined, only 74 were found to be conducted under commendable conditions.

Following are the results of the examination of the larger establishments, situated in Boston, Cambridge, Chicopee (Brightwood), Somerville and Worcester: —

North Packing and Provision Company, Somerville. — *Pork Packing.*

This is a large establishment, with a number of separate departments, described below.

Hog House. — This has an area of 5,921 square feet, and is eight stories high. Each floor is laid with bricks, and is divided into pens about 40 by 50 feet in area.

The hogs are driven up inclines from floor to floor as soon as they arrive at the establishment. If they are not to be killed at once, they are given a feed of corn and are watered; but forty-eight hours is the longest interval between arrival and slaughter.

The place is washed down every day with a hose. The floors drain into the sewer. The condition is most satisfactory.

Killing Room. — This has an area of nearly 12,000 square feet, and is fairly lighted and properly ventilated. From the killing pit the hogs are dropped through a chute into a vat of hot water. When the carcasses have been scraped and dressed they are hung up to cool. As the slaughtered animals pass along they are examined by two government inspectors, stationed about 75 feet apart. One looks and feels for glands, etc., in the neck; the other looks at the viscera. Condemned carcasses are split with an axe and are sent to the rendering tanks.

As the animals are dressed the offal is sent by chutes to the floor below.

The floor of the killing room is constantly in process of cleaning, and is scrubbed thoroughly every night.

Hog Coolers. — The hogs are chilled in two rooms, each of about 10,000 square feet area, divided into compartments. The carcasses remain here about forty-eight hours. The floors are covered with sawdust and are cleaned frequently. As these rooms are kept at a low temperature, ventilation is not attempted, nor is it needed.

Cutting and Trimming Room. — This department has a total area of about 10,000 square feet. Here the carcasses are cut on benches, each workman having his own part to perform. The floors and benches are scrubbed and scraped daily. Since warm air would tend to promote spoiling, direct ventilation is not employed in warm weather.

Sausage Manufacturing. — This department covers almost 19,000 square feet. The lighting and ventilation are excellent. The materials used are pork trimmings and "barrel beef," which is bought outside. The meats are cut into small pieces and fed into grinders, from which the product falls into wooden tubs. After thorough mixing by machinery it goes to the stuffing machine, in which it is forced into casings. The sausages known as frankfurters and bolognas are next boiled and smoked, and finally are washed and cooled.

All machinery is cleaned thoroughly after use, and the floors and tables are scrubbed daily. A man leaving the room is not permitted to return to his work until he has washed at the basin in the corner of the room, and the foremen are held accountable for infractions of this rule.

Preparation of Sausage Casings. — In a room of about 3,750 square feet floor space, well lighted and ventilated, 20 men are employed preparing intestines for sausage casings. The intestines are washed and passed through a machine which presses out all contents, and so works that practically nothing but the muscular coating is left. After being tested for perforations and washed, the casings are packed in dry salt.

The room in which this work is carried on has a wooden floor, which, though wet, is kept in properly clean condition. Owing to the nature of the material, there is some unavoidable odor.

Curing Cellars. — In three cellars, having a combined area of nearly 56,000 square feet, 30 men are engaged in curing hams and bacon. These are treated in large vats of concrete built up from the floor, each of which has a removable wooden floor laid in sections, which can be taken up and cleaned from time to time.

The temperature of the cellars is maintained at about 35° F., and the air is saturated with moisture. These conditions are said to be necessary in the curing process.

Soaking and Washing Hams. — In an artificially (poorly) lighted, well-ventilated room of 4,000 square feet, 40 persons are engaged in washing and scrubbing hams after they have been taken from the pickle and soaked in tanks of water. Here, also, boxes, crates and barrels are washed and scrubbed. The floor is of cement, covered with boards, and is very wet.

Offal and Rendering Department. — This department occupies four floors, with a total area of more than 47,000 square feet. The light is fair; the ventilation is mechanical and adequate.

The offal comes through galvanized-iron tubes from the killing rooms. The tongues and other useful organs are trimmed and put aside. The intestines are stripped from the mesentery, and some of them, after being split and washed, are sent to the rendering tanks together with other parts which yield fat. The tanks contain water which is heated until all the fat from the meat, scraps, etc., rises to the top, from which it is drawn off through a pipe. The tank residue is removed and pressed, and then disposed of for making fertilizer. The bones, after removal from the tanks, are dried and used in various ways.

The iron chutes are scoured with washing soda and hot water every night. The floor and tables are washed and scraped, and the whole place is kept in good order. There is practical freedom from flies.

Beef Salting. — In the basement of the cold-storage building, in a room of nearly 18,000 square feet of floor space, rather poorly lighted and inadequately ventilated, 7 persons are engaged in salting "plates" and briskets obtained from the large beef concerns in Boston. These parts, for which in the fresh state there is small demand at retail, are trimmed, cut into pieces of suitable size and placed in barrels of brine, to which a small amount of saltpeter is added.

The floor is of wood over cement, and is clean. The room is cold and damp.

Preparation of Pigs' Feet. — Pigs' feet are cleaned, scraped and pickled by 12 men, whose work is carried on in a properly ventilated and adequately lighted room of about 7,000 square feet of floor space.

Night Work. — The whole plant is cleaned every night by a force of 60 to 70 men, who start at the killing room, which already has been cleaned and washed by the day men before leaving at night. All machinery, tables and floors are scrubbed with hot water, soap powder and scrubbing brushes. The scalding vat is cleaned thoroughly, as is the entire department in all particulars. Next the cutting and trimming rooms, the rendering plant and all other departments are attacked, and the whole establishment is finished by 6 o'clock in the morning.

The employees number about 1,100, and include representatives of many nationalities. All who were seen appeared to be in fair or good health.

About 90 per cent. eat their noonday meal at home; the others eat about the buildings or in a lunch room that is provided.

Very little spitting was observed anywhere about the plant.

J. P. Squire Company, East Cambridge. — Pork Packing.

This establishment is housed in a number of buildings of brick or wood, in fair condition and fairly well ventilated and lighted. The employees number about 800, of various nationalities, all apparently in good health. Very little spitting was observed. More than half go home to dinner; the rest eat in a restaurant provided by the company, or in the yard or workrooms. The restaurant is clean, and the food is of good quality and served at low prices. Those who prefer to bring their own food may eat it in the restaurant if they so desire.

While adequate provision is made for comfortable eating, the accommodations for hanging street clothes and for washing are somewhat meagre.

The establishment is divided into a number of departments, as follows: —

Hog House. — This building covers more than 25,000 square feet, and contains three stories, each of which is divided into pens, in which are troughs of water. The light is good, the ventilation free, the sides being open. After each lot of swine is disposed of the floors are thoroughly cleaned.

No slaughtering is done at this plant. The hogs are driven over a bridge to the killing rooms of the North Packing and Provision Company, and are returned over another bridge to the cooling rooms, which occupy three floors of a building having an area of 64,000 square feet (400 by 160 feet). These rooms are lighted by electricity, and are kept at a low temperature. The floors are scraped whenever necessary for the removal of the slight amount of blood which drips from the carcasses.

Cutting Room. — The cutting operations are performed by about 75 men, on a floor space of about 30,000 square feet. The various parts are dropped into barrels or trucks, or go by chutes to others below. No spitting was noted.

Curing Cellars. — Each of the curing cellars (four or five in number) covers about 43,000 square feet. Here the pork is piled in stacks 20 or more feet square, and cured with salt; and the hams and bacon are cured in tierces filled with a pickling solution of sugar, salt and saltpeter. These two processes require from thirty to seventy days.

The cellars are kept at a temperature of about 50° F. The floors are necessarily wet, but they are clean.

Soaking and Washing Hams, etc. — Before going to the smokehouse, the hams and bacon are sent to a large basement, where they are soaked in tanks of water and then washed with hot water and brushed. The floor is of cement, covered with wood. The light is poor.

Sausage Making. — The trimmings from the cutting room and "barrel beef" (government inspected) brought from elsewhere are mixed on tables, cut up by machinery, and mixed with salt, saltpeter and spices. The mixture is stuffed into casings, and the sausages are linked, boiled and sent to the smokehouse. The room in which this work is done is fairly well lighted, naturally ventilated and heated by steam. It covers 10,000 square feet. The floors, machines and all utensils are cleaned with hot water and brushes every day. A man leaving the room for any purpose whatever is obliged to wash his hands before resuming work.

Preparing Pigs' Feet. — In a room 25 by 30 feet 10 men and boys are employed scalding, scraping and treating pigs' feet. The nature of the work is such that the floors look untidy, but they are frequently cleaned and scraped.

Rendering Room. — In this department fat for lard is rendered in separate steam tanks, and trimmings and offal are tried out for grease in another set. The several products are drawn off from above, and the tank liquor and residue are discharged to floors below. The liquor is concentrated, and ammonia stock is recovered. The tankage is pressed dry, then further dried by steam, and the product is disposed of as fertilizer. The general conditions in this department are good, and the tanks and floors are kept in a clean condition.

Box Making. — The box factory occupies three floors of a building covering 15,000 square feet. The light is good and the ventilation excellent. Nearly all of the woodworking machinery is guarded, and practically every dust-producing machine is provided with zinc hoods and suction draft for the removal of dust and shavings. A dovetailing machine is not so provided, but to do so would be difficult, on account of its construction and manner of working.

Brighton Abattoir, Boston. — Slaughtering and Rendering.

This establishment contains a number of slaughtering and other departments, all owned by the corporation and let subject to its regulations. An inspector of the board of health of Boston is on duty all the time, and has absolute authority so far as its sanitation is concerned. He inspects and passes upon each carcass before it can be removed. The whole plant is in good order; it is properly lighted, drained and ventilated in every part.

The different slaughtering places vary in size, but are of practically the same construction. All have wooden floors that drain to a trough leading to the cellar. The blood is caught in this trough during slaughtering, and is converted afterwards into fertilizer. The cellars have cement floors, sloping to points provided with strainers. They are flushed every night with a hose. All floors are scrubbed daily.

The offal is sent by chutes to appropriate places beneath the killing rooms, and is taken by a company which maintains a plant on the premises.

A number of those who slaughter here have cold-storage rooms operated from a central plant.

In addition to slaughtering and the treatment of the ordinary by-products, rendering and the manufacturing of oleo oil are carried on.

Oleo Oil Manufacture. — A basement, 75 by 35 feet, is used for sorting and trimming fat. The light, ventilation and drainage of the concrete floor are good. The fat is washed by cold spray and sent upstairs on an endless chain to the oleomargarine house, where it is ground, placed in kettles and melted. Next it is clarified and allowed to stand until the stearin separates, then is pressed through canvas and barrelled.

Rendering. — The offal from the slaughtering establishments and bones and fat from the markets are brought together in a basement, 170 by 60 feet, and sorted. Dead animals from outside are brought here also. The materials are taken to appropriate tanks, and heated until the fat separates. This is drawn off and is sold, chiefly to the manufacturers of soap. The tank residue is subjected to pressure, and disposed of as fertilizer. Sometimes the meat scraps are converted into poultry feed. The bones are cleaned and dried.

This department is clean and properly ventilated. The floors are swept when soiled, but are not washed except when all the tanks on one side are empty. All odors and gases are conveyed from the tanks by ventilation pipes to the furnaces, where they pass through the fire and are destroyed.

The men employed about the abattoir are of all ages, from twenty to sixty. All appear to be healthy. Very little spitting was observed. Many of the men eat their dinners in the workrooms or on the grounds.

New England Dressed Meat and Wool Company, Somerville. — Slaughtering.

This is a slaughtering and rendering establishment, which includes a number of departments. It is clean, and has good light and ventilation. A new system of toilet rooms has been planned, and will soon be installed. In this, the exit from the water-closets is a wash room provided with basins and towels, which visitors to the water-closets will be obliged to make use of before returning to work. Such is the rule at present, but the arrangements are not so convenient as those planned. The departments of this establishment are described below.

The employees number about 250 on an average (350 when the plant is running to the limit of its capacity). They are of several nationalities, and all appear healthy. Very little spitting was observed in some departments, and none in others.

Killing Room. — Area, 8,840 square feet. Light and ventilation good. Occupants, 50 to 60.

The sheep are slaughtered in one part of the room, the cattle in another.

After slaughter the carcasses are hung, and the skinning and cleaning are completed. The meat does not touch the floor at all. The entrails are sent by chutes to the basement, each part by a separate chute. The blood runs to a channel in the floor and thence to the cellar. The floor is thoroughly scrubbed each day when the work of slaughtering is finished.

The carcasses are hung in a cooling room for about an hour before going to the large refrigerators. The floor of the cooling room is scrubbed daily. The refrigerators are given fresh sawdust daily, and are scalded every three or four weeks.

Offal and Hide Cellar. — The offal is handled by 20 men, and the hides by 30, in a cellar having an area of 36,400 square feet. The light is rather poor, and is chiefly electric. The floor is of brick and cement, and slopes for drainage to several strainers, and after the day's work is done it is washed down with a hose.

Rendering House. — The operation of rendering is carried on in a building of five stories, each with 3,744 square feet of floor space. The lighting is good in every part. The scraps, fat, bones, etc., are treated in rendering tanks in the top story. The fat is drawn off into barrels, and the residue is pressed and converted into feed for poultry, or subjected to more heat and pressure and converted into fertilizer. This building is clean in every part.

Sausage-casing Room. — The intestines are cleaned and scraped in a room 40 by 35 feet, and after being tested for perforations are salted. Condition, clean.

Oleo Oil Making. — The choicest fat after trimming and sorting is washed in several changes of water, then is ground and transferred to large steam-jacketted kettles, in which it is heated with constant stirring. It is then piped to kettles on the floor below, where it is clarified. Then it passes to another lower floor, where it is drawn into tanks and allowed to stand until the stearin separates, when it is pressed through cloths, for the removal of the stearin, and barrelled. The entire process is conducted with great regard for cleanliness. The kettles, tubs, tanks, etc., are thoroughly scalded and scrubbed after each time used.

These several operations are conducted in rooms of 2,700 square feet of floor space, in three stories. Each floor has drainage troughs, and is clean.

Skin Cleaning. — In a room with 8,900 square feet of floor space, provided with good lighting and ventilation, the skins are scrubbed and cleaned and the wool is removed. They are then put through several processes of curing. The floor is wet, but properly drained.

Sturtevant & Haley Beef Supply Company, Somerville. — Slaughtering and Rendering.

The building is of wood, and four stories high. The slaughtering is done on the ground floor, in a room about 50 feet square, by Jewish rabbis, and the product is "Kosher" or not, according to the findings on inspection. The animals killed are steers. The throat is cut and the head nearly severed by a single transverse cut of a heavy knife. The government inspector examines each carcass, as does also the rabbi, who rejects all animals with pleural adhesions, lung cavities or perforated viscera. Nearly all of the viscera go to the rendering tanks for grease and fertilizer, though a few livers and hearts are sold. The killing room has good light and ventilation, and is kept in a clean and neat condition.

The rendering tanks are in the upper story. The products are oleo oil, stearin, tallow and dried tankage.

The workmen have a healthy appearance, and spit very little.

White, Pevey & Dexter Company, Worcester. — Pork Packing, etc.

The various departments of this establishment are distributed among several buildings, chiefly of brick. At present the water-closets are in corners of workrooms, and no facilities for washing are provided; but on each of the floors arrangements are being made for adequate closets, the exits from which will lead into wash rooms provided with running water, basins, soap and towels. It is planned, also, to have cement floors and a ventilating shaft with an exhaust fan on the roof.

The *hog houses* are two wooden buildings, 40 by 80 feet and 30 by 60 feet, respectively, with two and three floors, respectively. Light and ventilation are good. The hogs are driven into the pens, where they are watered. The floors, now badly worn, but soon to be renewed, are washed down with a hose.

The *killing room,* 100 by 59 feet, has fairly good light and good ventilation and is heated by steam. The hogs enter from an inclined runway outside the building, and as soon as they are killed they are sent to a chute by which they drop into scalding water. The blood goes directly to a tank, in which it is reduced to fertilizer.

After the hogs are cleaned and opened they are examined by a government inspector, then split and hung up to cool.

The room as a whole is fairly clean, and is washed with more or less thoroughness every day.

The *cutting room,* 35 by 60 feet, is fairly well lighted, but is neither heated nor ventilated, it being necessary to maintain a low temperature.

Soaking and Washing Room. — This room, 25 by 75 feet, is in a basement and has a cement floor, sloping to drains in the center. The light is fair, ventilation good, and the heating is by steam. Here, hams from the curing cellars are soaked in tanks of water and washed off before being subjected to the smoking process. Here, also, all trucks, boxes, barrels, etc., are washed with hot water and brooms or brushes.

Sausage Making. — The manufacture of sausages is carried on by 12 workmen, in a room having a floor space of 1,350 square feet, fairly light, well ventilated and heated by steam. The machinery and utensils were found to be in clean condition. The wooden tables and trucks are to be replaced with galvanized iron. Many flies were about.

Preparation of Casings. — In a poorly lighted but fairly well-ventilated steam-heated room, having 1,125 square feet of floor space, 10 persons are engaged in scraping (by machinery), washing and salting intestines for sausage casings. The room is wet and unclean; and the air is unavoidably malodorous from the intestinal contents.

Rendering Department. — This occupies three floors, each of 1,250 square feet area. The light is poor, and ventilation is not specially provided for. The rooms are heated by steam.

On the third floor are six steam tanks, one of which is used for converting blood to fertilizer, two for trying out offal and three for lard. The grease is drawn down into settling tanks and coolers on the next floor. The tank liquor is drawn down into the basement floor, where it is evaporated to the consistency of thick glue, and later is added to the tank residue after the latter has been pressed and dried.

The employees are healthy looking, and spit but little.

Springfield Provision Company, Brightwood. — Slaughtering and Pork Packing.

This establishment is situated on the bank of the Connecticut River, and has its own water supply and drainage system. The buildings are more than twenty years old, and are not well arranged as to light, ventilation and facilities for cleaning. Alterations are in progress, which include the installation of several sets of closets and sinks. Hitherto, hot water, soap and towels have not been provided for the workmen. Excepting in the cold-storage rooms and smokehouse, the place is extensively infested with flies.

In the cold-storage rooms there is much condensation of moisture, and elsewhere an excessive amount of water is discharged on the floors, nearly all of which drain badly, and in consequence are very wet.

About 225 workmen, chiefly Poles, some Irish and French, a few Italians and native-born, have a fair to good healthy appearance. Not much spitting was observed. Sand boxes are provided for those who have the habit.

The time allowed for the noonday meal is a half-hour. Some eat out-doors in good weather, but ordinarily nearly all eat somewhere about the buildings. No place is provided for the purpose.

The establishment includes the following departments: —

Hog House. — This is a building, 225 by 60 feet, divided into pens 40 by 45 feet, capable of holding 90 to 100 hogs each. The hogs are seldom kept more than twenty-four hours before slaughter. The pens are washed down with a hose as soon as the hogs are sent to the killing room, and then are in fairly clean condition. Light is fair and ventilation good.

Killing Room. — This is a large room, 70 by 80 feet, in the top of the building. It is well lighted, and the ventilation is adequate. The hogs are driven up a long incline, and as they enter they are caught up by one leg and sent along a narrow passageway, where they are stuck in the neck. As they are carried along they bleed on the zinc-covered floor, from which the blood drains into a pipe. The carcasses are next dropped into scalding water, from which they are soon withdrawn, ready for the cleaners. After being scraped they pass along and are eviscerated. Each carcass is examined by two government inspectors, one of whom looks and feels for glands in the neck, and the other inspects the viscera, which are thrown upon a table before him. The carcasses condemned and tagged are sent to the grease tanks. The viscera are sorted out and thrown into trucks, or sent below through zinc-lined chutes. The fat stripped from the intestines goes through a chute to the lard tanks.

After the day's slaughtering is completed the place is washed down with a hose.

Most of the workmen in this room work barefooted.

Cold Room. — Before being chilled in this room, which is 108 by 160 feet, and is maintained at a temperature of 30° F. or lower, the hogs are allowed to cool in a light and airy room, the floor of which is covered with sawdust and frequently cleaned. The cold room is lighted by electricity, and necessarily is not ventilated. It is divided into five sections, which are filled in turn. The floor slopes to a galvanized-iron gutter, which carries away the water used for cleaning. The hogs remain here about twelve hours, and then are sent to the cutting room.

Cutting and Salting Room. — This room, which has a floor space of 21,000 square feet, and is occupied by about 125 workmen, is properly lighted, but, because of the necessity of keeping a low temperature, is not provided with means of ventilation; but it is occupied but a few hours at a time. Here the carcasses are cut up and distributed, and meat is stacked for dry-salting or placed in barrels for storage. The floor is wet, but is said to be cleaned every day or two. Sand boxes are provided, and no spitting on the floor was observed.

Trimming Room. — In this room, which is 108 by 65 feet, properly lighted, and maintained at a temperature of about 35° F., 50 persons are engaged about three hours daily trimming small pieces of meat. The room is clean.

Preparation of Sausage Casings. — This work is carried on by 10 persons, in a room with good light and ventilation, having a floor space of 1,200 square feet. The intestines are scraped, washed, tested for perforations and packed in salt. The room is kept clean, and is not more odorous than is to be expected, considering the nature of the material treated.

Soaking and Pickling Cellar. — Here, in a temperature of about 40° F., hams and bacon are soaked for from forty to seventy days in a pickling solution of salt, sugar and saltpeter. They are then taken out, soaked in water, washed with cold water and a stiff brush, and then carried to the boning rooms. The floor is of cement, with a board covering.

Boning and Trimming Rooms. — Here the bones are removed from the hams, which are then placed in tin holders, in which, before being taken to the smokehouse, they are boiled. This department includes several rooms, properly lighted and ventilated, each about 25 by 50 feet.

Sausage Making. — Five rooms are given up to the manufacture of sausages. They are all fairly well lighted and ventilated, and have floor spaces ranging from 800 to 2,250 square feet. They are heated by steam. In the cutting and mixing room, 40 by 50 feet, the meat from the trimming rooms is mixed with government-inspected-and-stamped "barrel-beef," salt, saltpeter and spices, and ground by machinery. No other preservative substances are employed. The casings are filled in a second room, 30 by 75 feet, and the sausages then pass to a third room, 30 by 40 feet, where they are boiled in a wooden tank. They are packed in another room, 20 by 40 feet, and then placed in cold storage. The greater part are smoked in the smokehouse. The floors of the sausage rooms do not look clean, but they are said to be washed daily with water.

Rendering Lard and Grease. — Eight tanks are in use: five for lard, two for grease and one for blood. They are on the third floor. Portions of three floors are in use. When the tank contents have been heated sufficiently long, the fat is drawn off at the upper level and the water and residue through the bottom. The lard and grease go at once to settling tanks below. The lard, after appropriate treatment, is pumped to the filling room, where it is run into pails. On the lower floor the tank water is drained away, and the residue is pressed and dried for fertilizer.

Preparation of Pigs' Feet. — Six men, in a properly ventilated and fairly well-lighted room, 30 by 45 feet, clean and shave scalded pigs' feet. The place naturally is wet and somewhat dirty, but otherwise is unobjectionable.

Washing Room. — All trucks, utensils, etc., are taken every night to a room 30 by 60 feet, where they are washed with warm water and stiff brushes. The proper cleaning of wooden trucks and tubs is not a simple operation, and 5 or 6 men are engaged at this work every night.

Springfield Rendering Company, Brightwood. — Slaughtering and Rendering.

In this establishment, which occupies a brick and wooden building two stories in height, situated on the bank of the Connecticut River, the chief business is rendering. The slaughtering is done by Jewish butchers, each killing his own animals, and the meat is "Kosher." The animals slaughtered are chiefly cows and calves, and they number about 50 per week. They are kept in a small, not clean yard, from which they are driven up a short incline to the killing room, the floor of which is double, and slopes slightly to drain in the middle. This drain has two plugs, one of which closes the opening to the rendering tanks (for blood), and the other that of the outlet for wash water, which drains to the river.

The killing room is cleaned by the company when the day's slaughtering is completed. Since those who use the place kill at all hours of the day, it is difficult to keep it in a cleanly condition, and the place is infested by flies. The rabbi makes his inspection at the time of slaughter, and a second inspection is made by the local inspector. The carcasses are carried away, not chilled, within a few hours, although a cold-storage plant is maintained on the premises.

The company makes oleo oil from suet and fat collected in the markets and sent in in ice. This material is trimmed and washed and put into steam kettles, after being finely minced by machinery. It is heated to 170° F. for several hours, and the liquid fat is drawn off into wooden tanks. After the stearin has separated, the material is pressed through cloth and the oil is conveyed to a storage tank, from which it is drawn into barrels for export. The stearin is used in this country for various purposes. The building in which this work is conducted is clean and neat throughout.

Another operation conducted here is that of bone grinding, in which process much fine and irritating dust is evolved. One man manages the machine, and has done so for three years without discomfort or injury.

The chief business is curing hides and rendering. The products are hides, bones and bone dust, stearin, oleo oil, fertilizer and ammonia stock.

Of the 201 small slaughterhouses visited, in 107 cities and towns, 74 were found to be in at least reasonably satisfactory condition, and of this number 34 merited especial commendation. The great majority of those in which the conditions were found to be objectionable were exceedingly filthy, even though provided with running water. The details of the examinations have been presented in the "Monthly Bulletin" of the Board, and may be found also in the annual report for 1906. For present purposes it will suffice to record below the places in which the establishments visited are situated, and the number of each class found; and to call attention to the fact that the provisions of the law relative to slaughtering are very generally ignored.

Thus, section 99 of chapter 75 of the Revised Laws provides that the proprietor of every slaughterhouse shall apply annually, in April, to the local authorities for a license, stating in his application, which must be in writing and properly sworn to, the estimated number of animals to be slaughtered per week, and the days of the week upon which they are to be slaughtered. Section 100 provides for the issuing of the licenses. Section 101 prohibits slaughtering on any days other than those specified in the application, except in the presence of a member of the board of health or of an inspector appointed for the purpose by the board; section 102 provides for the presence of the inspector and for examination of the carcasses at the time of slaughter. Section 105 exempts those who, not being engaged in such business, slaughter their own animals on their own premises; but it provides for proper inspection of the carcass of any animal, more than six months old, which has not been inspected under the provisions of another law within six months. Section 106 provides a fine of not more than $500 or imprisonment for not more than sixty days, or both fine and imprisonment, for slaughtering without a license, or for neglecting to cause carcasses to be inspected, or for selling a carcass or part thereof that has not been inspected. And yet many of the proprietors of these slaughtering establishments hold no licenses; some of the places are used by an indefinite number of unlicensed butchers from neighboring cities and towns; an inspector is rarely present at the time of slaughter; in not a few instances the person appointed as inspector is the licensee himself; sometimes the inspector is sent for, and calls on the following day; sometimes meat condemned in one place is removed to another town, and there inspected, passed and stamped, for a small fee per carcass; and more often carcasses are not inspected at all, and consequently are not condemned, even though showing evidence of disease.

Slaughterhouses visited.

City or Town.	Number with Satisfactory Conditions.	Number with Objectionable Conditions.	Total.	City or Town.	Number with Satisfactory Conditions.	Number with Objectionable Conditions.	Total.
Acton, . . .	-	1	1	Dighton, . .	1	1	2
Agawam, . .	-	1	1	Dracut, . . .	3	3	6
Alford, . . .	-	1	1	Duxbury, . .	2	-	2
Amherst, . .	1	3	4	Egremont, . .	1	1	2
Andover, . .	1	1	2	Essex, . . .	1	-	1
Arlington, . .	1	-	1	Fall River, . .	-	1	1
Ashburnham, .	1	-	1	Fitchburg, . .	-	2	2
Ashfield, . .	-	2	2	Gloucester, . .	-	2	2
Ashland, . .	1	-	1	Granby, . .	1	2	3
Athol, . . .	1	-	1	Great Barrington,	-	1	1
Attleborough, .	-	1	1	Greenfield, . .	-	1	1
Auburn, . .	1	-	1	Hampden, . .	-	2	2
Barnstable, . .	8	1	9	Hanson, . .	1	1	2
Bedford, . .	1	-	1	Harvard, . .	1	1	2
Belchertown, .	2	1	3	Haverhill, . .	2	1	3
Beverly, . .	-	1	1	Holliston, . .	-	1	1
Billerica, . .	-	2	2	Holyoke, . .	-	1	1
Boxford, . .	2	-	2	Hubbardston, .	3	2	5
Bridgewater, .	-	2	2	Hudson, . .	1	1	2
Brockton, . .	-	1	1	Lanesborough, .	1	-	1
Cambridge, . .	3	-	3	Lee, . . .	1	3	4
Chelmsford, . .	2	5	7	Lenox, . . .	1	2	3
Cheshire, . .	-	2	2	Leominster, . .	-	1	1
Clinton, . . .	-	1	1	Lexington, . .	1	4	5
Concord, . .	-	1	1	Longmeadow, .	-	1	1
Conway, . .	-	1	1	Ludlow, . .	-	1	1
Cummington, .	-	1	1	Lynn, . . .	-	2	2
Dalton, . . .	-	2	2	Lynnfield, . .	-	1	1
Danvers, . .	-	2	2	Marlborough, .	-	1	1
Dartmouth, . .	-	4	4	Medfield, . .	1	-	1
Deerfield, . .	2	-	2	Medway, . .	-	1	1

Slaughterhouses visited — Concluded.

City or Town.	Number with Satisfactory Conditions.	Number with Objectionable Conditions.	Total.
Merrimac, . .	-	1	1
Methuen, . .	-	4	4
Middleborough, .	-	1	1
Milford, . .	1	-	1
Montague, . .	-	1	1
New Bedford, .	-	1	1
Newburyport, .	-	2	2
North Adams, .	-	2	2
Northampton, .	-	1	1
Norwell, . .	2	2	4
Palmer, . . .	1	-	1
Peabody, . .	1	-	1
Pembroke, . .	3	-	3
Pittsfield, . .	1	2	3
Plymouth, . .	1	1	2
Raynham, . .	-	1	1
Reading, . .	-	1	1
Rehoboth, . .	-	1	1
Rockland, . .	-	2	2
Rowley, . .	1	2	3
Sheffield, . .	1	2	3
Sherborn, . .	-	2	2
Somerville, . .	-	1	1
Southampton, .	-	1	1
Southborough, .	1	-	1
Stockbridge, . .	-	2	2
Taunton, . .	1	3	4
Wakefield, . .	1	-	1
Watertown, . .	1	-	1
Wenham, . .	-	1	1
Westfield, . .	-	1	1
Westford, . .	-	1	1
West Newbury, .	-	1	1
Weston, . .	1	-	1
Westport, . .	2	2	4
Westwood, . .	1	-	1
Weymouth, . .	1	-	1
Whately, . .	-	1	1
Whitman, . .	1	-	1
Wilbraham, . .	1	-	1
Williamstown, .	-	2	2
Windsor, . .	-	2	2
Worcester, . .	2	1	3
Worthington, .	-	1	1
Totals, . .	74	127	201

Bakeries.

Chapter 75 of the Revised Laws (sections 28 to 34) requires that all buildings occupied as bakeries shall be properly drained and plumbed; shall be provided with proper wash rooms and water-closets, having ventilation apart from the bakeroom or rooms; and shall have, if required by the local board of health, an impermeable floor of cement or of tiles laid in cement, and an additional floor of wood properly saturated with linseed oil. It further requires that the walls and ceiling of a bakeroom shall be plastered or wainscotted, and, if required by the local board of health, shall be whitewashed once in three months; and that the furniture and utensils shall be so arranged that they and the floor may at all times be kept clean and in sanitary condition. It requires also that the manufactured products shall be kept in perfectly dry and airy rooms, so arranged that the floors, shelves and all other facilities for storing the same can be easily and perfectly cleaned. It prohibits having a water-closet, earth-closet, privy or ash-pit within or communicating directly with the bakeroom of any bakery; and provides that sleeping places for employees shall be separate from the rooms in which flour or meal and food products are manufactured or stored.

Bakeries and confectionery and catering establishments, to the number of 547 were visited, in 25 cities and 3 towns. A study of the conditions observed led to the division of these establishments into four distinct classes, as follows: —

Class A. — Worthy of especial commendation.
Class B. — Satisfactory.
Class C. — Not especially bad.
Class D. — Distinctly bad.

Of Class D many are situated in badly lighted, unventilated basements, and some of them have water-closets either in the bakeroom itself, or so placed as to make the air thereof distinctly foul.

In order to warrant classification under A or B, the following conditions have been required: —

1. The situation of the room is not below the street level.

2. The size of the room is such that there is sufficient air space per capita.

3. Ventilation is adequate.

4. There are windows enough to secure good light. Artificial light is not needed during the daytime.

5. Everything is open, and easily inspected.

6. The floor is properly constructed, without large cracks.

7. The floor is clean (*i.e.,* reasonably clean during work hours, and always free from accumulated dirt).

8. The ceiling and walls are unbroken and clean.

9. Tables and troughs are clean, and so arranged (preferably portable) that the floor beneath may at all times be kept clean.

10. The sink and its surroundings and all shelves are clean, and free from decayed wood and decomposed vegetable matter.

11. The water-closet is neither in nor connected with the bakeroom and other rooms where food products are kept.

12. Employees do not use the bakeroom for a dressing room. Street clothes and underwear are not hung on bakeroom walls nor placed on the floors; neither are they laid on boxes nor within a closet in the bakeroom.

The following table, which was published in the "Monthly Bulletin" of the Board for August, 1906, shows the number of establishments examined in each place, and their classification: —

Place.	Number visited.	A.	B.	C.	D.
Attleborough,	4	-	-	3	1
Boston,	157	4	14	85	54
Brockton,	7	-	1	3	3
Cambridge,	41	1	6	18	16
Chelsea,	10	-	2	4	4
Chicopee,	6	-	-	2	4
Clinton,	8	-	-	-	8
Fall River,	20	-	-	7	13
Fitchburg,	10	-	-	3	7
Framingham,	4	-	-	-	4
Gloucester,	7	-	-	4	3
Haverhill,	4	-	1	1	2
Holyoke,	22	-	1	8	13
Lawrence,	28	-	1	12	15
Lowell,	35	-	-	10	25
Lynn,	23	1	1	11	10
Malden,	10	-	2	3	5
Medford,	4	-	-	2	2
New Bedford,	19	-	-	9	10
Newburyport,	15	-	2	3	10
Quincy,	5	-	-	-	5
Salem,	18	1	2	8	7
Somerville,	20	-	-	6	14
Springfield,	15	1	1	4	9
Taunton,	4	1	-	1	2
Waltham,	8	1	2	3	2
Woburn,	4	-	-	1	3
Worcester,	39	1	8	11	19
Totals,	547	11	44	222	270

Because of some doubt on the part of local inspectors as to what is meant by "distinctly bad" conditions, and because the standard upon which the above classification is based is more exacting than that called for by existing laws, a division of Class D is made, merely to separate the bakeries which were found to be clearly not in accordance with the intent and meaning of the statutes from those concerning which reasonable doubt may arise.

In the new classification, basement bakerooms are considered alike with those otherwise located, and not so much stress is laid on certain points, *e.g.*, light and ventilation; hence, many of the rooms first placed in Class D fall into Class C. In addition, a list of all basement bakeries is given.

Place.	Number visited.	A.	B.	C.	D.[1]	Basements.
Attleborough,	4	-	-	4	-	-
Boston,	157	4	14	113	26	37
Brockton,	7	-	1	5	1	4
Cambridge,	41	1	6	19	15	8
Chelsea,	10	-	2	5	3	1
Chicopee,	6	-	-	5	1	4
Clinton,	8	-	-	4	4	6
Fall River,	20	-	-	12	8	8
Fitchburg,	10	-	-	5	5	5
Framingham,	4	-	-	3	1	-
Gloucester,	7	-	-	5	2	1
Haverhill,	4	-	1	2	1	1
Holyoke,	22	-	1	11	10	8
Lawrence,	28	-	1	20	7	3
Lowell,	35	-	-	24	11	11
Lynn,	23	1	1	13	8	6
Malden,	10	-	2	6	2	1
Medford,	4	-	-	4	-	1
New Bedford,	19	-	-	11	8	2
Newburyport,	15	-	2	6	7	5
Quincy,	5	-	-	1	4	4
Salem,	18	1	2	13	2	3
Somerville,	20	-	-	12	8	2
Springfield,	15	1	1	4	9	8
Taunton,	4	1	-	2	1	-
Waltham,	8	1	2	3	2	-
Woburn,	4	-	-	2	2	1
Worcester,	39	1	8	12	18	13
Totals,	547	11	44	326	166	132

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[1] "D" refers here to establishments with conditions not in accordance with the statutes.

The object of the investigation was, however, not to determine the number of "passable" bakeries, but to ascertain the conditions under which baking and similar kinds of work are carried on, both with regard to the employees and the consumers.

Cellar air that is vitiated by respiration, by illuminating gas, kerosene, and the gas from coke or coal, is not fit for the employees to breathe; neither is a cellar a suitable place for handling flour, dough, jellies, cream, milk, etc., which go to make up food products, particularly on windy days in summer, when the sidewalk windows permit ready entrance of street dust into the chocolate and cream fillings or the lemon and apple pie fillings, as not infrequently has been observed.

The walls of a very large number of bakerooms were found to be more or less dirty and uninviting, and especially were those repellant with cobwebs and greasy and filthy shelves for dirty pans and trays. The walls of some had hanging upon them trousers, coats, vests, shoes, underwear and stockings.

Not a few neat-appearing salesrooms of bakeries were found to lead directly into baking rooms which contain not only water-closets but filthy sinks, and where street clothes and other wearing apparel hang on the walls or rest on the tables and other furniture. In many of them, it was observed, the employees chew tobacco, smoke and spit about promiscuously; and in one a baker was seen to spit within a short distance of loaves that were stacked on the floor.

The best conditions were found to obtain as well in the small "home bakery" as in the large modern establishments managed by corporations; and the poorest conditions were observed not alone in the smallest establishments. Bakeries worthy of especial commendation were noted in Boston, Cambridge, Lynn, Salem, Springfield, Taunton, Waltham and Worcester; and others with satisfactory conditions in Boston, Brockton, Cambridge, Chelsea, Haverhill, Holyoke, Lawrence, Lynn, Malden, Newburyport, Salem, Springfield, Taunton, Waltham and Worcester.

Instances of Bakeries with Commendable Conditions.

Boston.

A. A small "home" bakery. The bakeroom is large, well lighted and ventilated, and is on the first floor. The water-closet is entirely separate. The whole place is exceedingly clean and neat.

B. A small bakery, employing 3 men. The bakeroom is new, and finely arranged as regards cleanliness and ease of cleaning. The light and ventilation are excellent. The water-closet is in an entirely separate part of the building.

C. A large bakery, employing 280 hands, who work in two shifts. The whole place is kept very neat and clean, and the rooms are light and well ventilated. The toilet rooms are separated from the rest of the bakery, and are ample. Great care is taken to have every part of the building in a cleanly condition.

D. A large bakery, well lighted and ventilated, and neat and clean throughout. A stone alley in the rear of the oven is provided for the removal of ashes, thus doing away with ash dust in the bakeroom. The toilet arrangements and metal clothes lockers are in the basement, away from the bakerooms, and are well ventilated.

Cambridge.

A building with ideal sanitary conditions, erected and equipped at great expense. Floors of stone, or cement covered with wood. Tiling readily washed. Rooms well whitened. Rooms well lighted (electricity for artificial lighting) and adequately ventilated. All departments clean and neat. Wash and toilet rooms in a separate part of building; separate porcelain sinks, with towels, for employees; metal lockers; stone floor; all conveniences modern; shower baths being constructed at time of visit. Employees not permitted to use tobacco while at work. Spitting not allowed in any of the rooms. Drivers of teams required to use gloves while driving, and to take them off when handling bread.

Lynn.

Second floor front room, 85 by 50 feet, exceptionally well lighted and ventilated. Distance from floor to ceiling 12½ feet. Eight windows. Floor well constructed, and clean. Tables and shelves covered with marble slabs and galvanized iron. Sink is of wood, and is away from partition, to prevent collection of dirt and filth in corners. Doughnut kettle well situated, and surroundings protected. Everything clean. The following notice is posted: "Please assist in keeping the wall and floor neat and clean." Toilet and wash rooms are situated far from the bakeroom, and the conditions in these departments are excellent.

Salem.

Large room, with store in front. Large store window. Ceiling plastered, clean and white. Sheathing from floor up to about 8 feet, then painted. Floor well constructed, and clean. Skylight window in front of oven, 8 by 5 feet. Clean galvanized iron in front of oven; clean floor under oven. Trough and tables clean underneath; troughs portable. Sink conditions admirable. Floor cleaned and scrubbed several times each week. Bakers clean and healthy appearing. Toilet room down stairs.

Springfield.

Room 175 by 60 feet. Twenty to 25 employees (day and night). Light good (three skylight monitors, about 8 by 10 feet; electric lights for night work). Ventilation good. Fire boxes in a back alley, thus preventing ash dust in the bakeroom in front of the oven. The well-laid maple wood floor is clean. Ceiling and sides of the room are sheathed. Height of ceiling, 16 or 18 feet. Tables movable. Sink and its surroundings clean. Four women keep the room in a cleanly condition. Doughnut room, separate from the bakeroom, 20 by 25 feet, is clean, light and pleasant.

Taunton.

Room about 30 by 30 feet, well lighted and adequately ventilated. High ceiling, wood sheathed. Good (new) floor, and comparatively clean. Room well painted. Sink conditions good. Closets for storage of pans and food stuff in good sanitary condition. Trays said, and appeared, to be scraped and cleaned frequently. Every week two men give the room a thorough cleaning and scrubbing. A woman aids in daily cleaning. The room, furniture and utensils have every appearance of cleanliness.

Waltham.

"Home" bakery with good light and ventilation. High-studded, clean room, covered with metallic sheathing. Good hard-pine floor. Oven rests on cement floor. Sink and surroundings clean. Water-closet upstairs, away from bakeroom.

Worcester.

High-studded room, 40 by 80 feet, with large front windows; good light and ventilation. Ceiling and walls plastered and whitewashed. The hardwood floor is scrupulously clean; one person employed solely for scrubbing and cleaning. Sink conditions excellent. No spitting.

Examples of Bakeries with Objectionable Conditions.

Boston.

A. Iron sink in small side room smells af if it were used as a urinal. When the water-closet upstairs is used, the water backs up a little in this sink.

B. Bakeroom is used as a playroom by two children about two and four years old, and a cat is allowed to wander at will about the bakery, into the bread pans, etc. Waste is thrown in a heap under the oven.

C. Place is untidy, but not very dirty. Spitting on the floor is practiced. The bakeroom is separated from the stable by a single door. The horse's stall is used as a urinal.

D. Spitting on the floor was seen. Water-closet, next to bakeroom, is dark and dirty and apparently has no outside ventilation. The bakeroom floor is dirty.

E. The water-closet is dirty and offensive. It is a dark, unventilated closet, leading off the cellar stairs just outside the bakeroom door. As the door to the cellar stairs is frequently open, and is always so when entering the water-closet, there is a direct ventilation of the water-closet into the bakeroom.

F. Water-closet in small side room, which also contains the sink. The door leading to the water-closet is kept wide open, allowing the odors to enter the bakeroom.

G. Large bakeroom, with bad light and poor ventilation; gas used here even on brightest days. Floor dirty, and covered with ashes and coal dust. Spitting on floor by workmen. Mixing room with poor light and only fair ventilation.

H. Light fair in middle of room, but poor at sides. Ventilation fair. Cats are allowed free run. Considerable spitting on the floor. The water-closet opens directly off the bakeroom, and the door is kept open, allowing free ventilation into the bakery. The hand sink is in the water-closet, but the towel is kept in the bakery.

I. First floor room. Water-closet, filthy and offensive, is in a corner of the cellar used for storing stock. Bakeroom is dirty and untidy. The floor is dirty. Eggshells and other waste are thrown in a heap under the oven. Flour and other stock are stored in the cellar near the water-closet. The cellar floor is damp, and in one place there is a pool of water.

J. Basement bakeroom. Light fair. Ventilation fair. Water-closet opens practically off bakeroom, allowing ventilation into room. Aprons hang in water-closet. Baker smokes, and spits on floor.

K. Basement bakeroom. Light bad. Ventilation poor. Water-closet off an outside passage, and has a window to bakeroom, which can be opened. No light in water-closet, and no outside ventilation. Floor of water-closet is wet and nasty. Sink in the bakery is kept covered, and a bucket is used in its place. Bakers smoke while at work, and spit on floor. Place untidy.

Brockton.

Light and ventilation fair. Floor in a nasty condition. Sink is nasty, as is also the water-closet in the corner of the bakeroom.

Cambridge.

Room 25 by 70 feet. Light and ventilation fair. Sink and surroundings dirty. Beans and other food stuff thrown under oven among coal and ashes. Table and woodwork behind it very nasty.

Chelsea.

Basement bakery, with poor light and no means of ventilation. Floor very dirty. Water-closet communicates directly with bakeroom, and is near flour and bread.

Clinton.

Cellar with fair light and ventilation. Water-closet is practically in the bakeroom, and is in filthy condition. About a foot away stands an open barrel of flour.

Fall River.

A. Rear room, badly ventilated, and so dark that three gas jets are required in the daytime. Water-closet is in the bakeroom, and the floor in its vicinity is exceedingly foul. The workmen spit about promiscuously. Sink conditions filthy.

B. Two rooms, badly lighted and ventilated. Trap of sink is stopped up, and drainage flows over the floor. Everything is filthy. Workingmen's clothes hang near bread troughs.

Fitchburg.

Cellar bakery, dark and unventilated. A very dirty place, with nasty shelves where bread is stored. Old clothes, towels, overalls, rubbers, etc., scattered about. Water-closet practically in the bakeroom.

Gloucester.

Cellar room, with fair light and ventilation. Under part of the floor is running water, said to be the overflow from a well. This is within three feet of a sink drain. Floor very nasty. Thick cobwebs, clothes, shoes and food material in close proximity.

Holyoke.

Room with very dirty windows and walls. Floor matted with dirt. Water-closet in the room. Pails of pie-filling near dirty clothing and shoes.

Lawrence.

Room dark and unventilated. Floor nasty. Conditions back of sink are filthy. Foul, dark, unventilated water-closet opens out of bakeroom.

Lowell.

Small, fairly lighted room, in the corner of which is a water-closet. Conditions about sink are filthy. Floor exceedingly dirty. Workmen smoke and spit promiscuously.

Lynn.

Cellar room, lighted by gas, and with no means of ventilation. Small sink, with nasty surroundings. Extremely offensive water-closet near by. All conditions absolutely bad. The shop upstairs has large windows, neat show cases and attractive display of products.

Malden.

An old room, poorly lighted and unventilated. Floor has large cracks and holes, containing food materials. Windows very dirty. Sheathing smoky. Shelves covered with dirt. Unclean conditions especially marked under the bread trough and back of and around sink.

New Bedford.

Dark and unventilated room, with water-closet opening out of corner. This closet is dark and filthy, and ventilates only into the bakeroom. The plastering is broken in several places. The trays are very dirty. The sink and surroundings are filthy. The ceiling is black.

Newburyport.

A. Room on street floor, 12 by 12 feet. Floor of boards laid on soil, with large cracks between. In the corner of another room is a sink, which receives the waste water from a sink in the story above. The collected organic matter in this sink gives rise to a very nauseating odor. The man in charge states that when "much stuff collects they shovel it out."

B. An old and very dirty room. Water-closet practically within the bakeroom. That part of the floor where ice cream is frozen is covered with dirt, which comes from ice, milk cans and other sources. There is a layer of accumulated filth from one-quarter to one-half inch in thickness. The scoops are kept in dirty water in an agate basin.

C. Basement room, very badly lighted by gas. Floor of concrete. Mixture of milk, eggs and sugar found standing in cans exposed to the cellar dust. Many flies observed floating in the mixture. A water-closet stands in the corner of the room. A short distance away and within two or three feet of the closet bowl is a large puddle of filthy water, due to the overflow from an obstructed drain.

D. Cellar very poorly lighted, by means of gas. Even with the gas lighted, it was impossible to see whether the cans and other utensils used were clean. The floor is partly cement and partly soil, and over a portion of it are loose boards, beneath which is an accumulation of stagnant water, which splashes between the cracks as one walks over them. General conditions exceedingly nasty.

E. Cellar room, with loose brick floor. Near the ice cream freezer, which is situated on the floor, is a gutter about five feet long, leading to a half-hogshead set into the ground in the corner. From the hogshead a pipe runs outside to the yard, but the pipe being plugged, the hogshead overflows. Near by is a window with a wire screen, and when the hogshead becomes full to overflowing, an employee dips the water out with a large pail and throws it through the screen, the network of which is in consequence partly obstructed with slime and filth.

F. Ice cream is made in a cellar having an area of 375 square feet. Over a portion of the soil floor are filthy boards. What light there is comes from two small windows. There is no ventilation. At the time of the visit a ten-gallon can was standing ready for a fresh mixture of milk and eggs, and it was said to have just been washed thoroughly with soap powder and hot water. On the bottom and sides of the can were thin layers of soft chocolate, which could be removed by rubbing with the fingers. Rewashing was advised, and the can was taken upstairs for that purpose; and it was noted that the water used for washing was not boiling, but was merely warm.

Quincy.

A. A small basement bakeroom, 25 by 20 feet, containing a bed with dirty bed clothes and filthy wearing apparel. Within a few feet of the oven and food materials is a dark, foul-smelling water-closet.

B. Basement room, 25 by 20 feet. Floor very dirty, and in places exceedingly nasty. Much smoke in the room. Ceiling very sooty. Employees chew tobacco and spit freely.

Somerville.

Rear room, with fair ventilation. Back of and around the sink the conditions are nasty. Water-closet leads out of and ventilates into bakeroom, the door standing open. Pails of pie-filling stand near the open water-closet door. Clothes closet in bakeroom, with door open.

Springfield.

Cellar room, 65 by 15 feet. Sink conditions filthy. Toilet and clothes room in a dark corner with door open, so that there is direct communication with the bakeroom. About six feet from the toilet room the following foods were found: milk, mincemeat, lemon and pastry. Under the oven were seen cans, paper, coal, dirt and accumulated food materials.

Taunton.

Distinctly bad conditions. Light fair. Ventilation fair. Shed in back yard with ash heap near. Low ceiling, smoky and very dirty. Stove funnel across dough table, covered with ashes and other dust. Eggshells, broken eggs, pasteboard and other clutter on floor. Wooden sink, very filthy, is boxed in underneath; its back and all parts are thoroughly nasty. Floor in front of sink nasty.

Waltham.

Fairly lighted and ventilated room, from one side of which a door leads directly into a room about 9 by 3½ feet. This door has no panel in the upper part, and was found wide open. The small room has two compartments, but the partition, in which is a door to the farther compartment, lacks several feet of reaching to the ceiling. One of these compartments, that nearest the bakeroom, is a dressing room, and the other is a water-closet. The whole place is dark and poorly arranged. This represents a not uncommon arrangement for water-closets, and raises the question whether the wording of the present law is sufficiently explicit. Some bakers claim that a toilet room thus placed is allowed by the present wording of the law.

Woburn.

Low-studded room, with poor light and ventilation. Small, dark dressing room in the corner contains old clothes and rubbish; the door stands open. Rubbish on top of old unused oven, — bottles, brushes, dippers, clothes, cobwebs and dirt. Utensils dirty. Shoes, trousers and rubbish on shelves. Ceiling black and peeling.

LAUNDRIES.

The public laundry business is one which has developed to a remarkable extent within recent years, and it gives employment to thousands of persons, chiefly adult women. More than one-fourth of the establishments visited employ more than 50 persons, and 3 of them employ more than 100. The heavy machine work is performed by men; but even for the lightest work girls are not extensively employed, although their services can be secured at lower rates than are commanded by women, because, so employers assert, they are far less attentive, and the amount and quality of their work is much inferior. In the 69 laundries visited there are employed 2,368 persons, divided as follows: men, 356; boys, 6; women, 1,860; girls, 146. Thirty-six of the 69 employ up to 20 persons each; 15 employ between 20 and 50 each; 15, between 50 and 100; and 3, between 100 and 160.

In the establishments of any considerable size the bundles are brought to the "markers," who open them, mark each piece if not already marked, and separate the "flat" from the "starched" work. The work of the markers is the most disagreeable of all, since each piece must be handled and examined separately. After sorting, the clothes are conveyed to the washing machines, where they are churned up with hot water and soap or washing powder for about twenty minutes. A bleaching agent is commonly added, to prevent the dingy or dirty look which otherwise they are likely to acquire. After removal from the washing machines they are transferred to rapidly revolving centrifugal machines, which quickly throw out the excess of water. A small proportion of special work is performed by hand in tubs.

After treatment in the centrifugal machines the articles are dried on racks in rooms heated to high temperatures by means of steam pipes. From the drying rooms the "flat work" goes directly to the mangles, by which it is ironed and folded ready for delivery. The "starched work" is treated with starch, usually by feeding into a starching machine, and the ironing is done in part by hand and in part by machinery. The finished material is conveyed to the sorting room, and after sorting is bundled for delivery.

The washing machines are run by men, and part of the heavy ironing is also done by men, but the rest of the work is done almost entirely by women.

In almost all of the establishments in which machinery is employed it is well protected; in 5 it is only partially protected. In 1, in which the machinery is not only not well guarded but also not easily stopped, a sign is posted which reads: "This machine is dangerous. Run it at your own risk!" but it is to be said that this place is small, employing only 4 persons, and that no accidents have occurred in thirteen years.

The mangles in use are in almost all cases equipped with a clutch, which, in the event of engagement of the operative's fingers, stops the machine instantly, and accidents are rare. In one establishment, employing 95 persons, 2 accidents had occurred in five years; in another, employing 15 persons, a hand was crushed some seven years ago, but no accident had occurred since; in another, employing 54 persons, 2 slight accidents, due to carelessness, had been recorded in fifteen years' operation.

The laundry business is not uncommonly regarded as one attended by more or less danger of contracting infective disease, because of handling the bed linen and body linen of sick persons; but the returns secured in this investigation do not support this assumption. Those who are most exposed to possible infection are the markers, who are obliged to examine and mark, if necessary, each piece submitted; but, while this work is disagreeable, there is no positive evidence that it is dangerous. As a rule, they are very skilful, and are not obliged to handle unduly the articles which they have to examine. Many of those questioned, including one who had worked continuously for twenty-two years, asserted that they had not lost a day in years of service. In one of the largest establishments, employing 150 persons, and in a large proportion of the others, it was said that very few cases of actual illness of any kind occurred in any year. In one, employing 52 persons, one or two cases of tuberculosis had occurred in twenty-seven years; but in a number of other large establishments no cases whatever were known to have occurred. It must be said, however, that in many of these establishments those who appear to be unable to do good work by reason of lack of strength are dismissed.

Many laundries refuse to handle very filthy clothes, and return such at once, and one goes so far as to cause their immediate destruction in the furnace; but some accept anything, no matter how foul, and report that the markers and sorters suffer no injury.

As a general thing, the establishments examined showed commendable conditions as to light, ventilation and general sanitation. In 3 of the entire number the light, and in 5 the ventilation, were distinctly bad. In 11 the water-closets were described as filthy. Several of the smaller places presented most unfavorable conditions. In one the pipe from the tank of the water-closet burst some years ago and has never been repaired, and the closet, which on the day of visit was full of excrement, has to be flushed with a bucket. In another, a "family laundry," the whole place was found to be dirty, the floor looking as though it had not been washed in months. Another, operated by 4 persons, in a dark front room and cellar, was in such a generally foul condition as to cause nausea.

On the whole, the establishments examined were open to but little criticism, and the employees appeared to be exceptionally well and strong.